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March 15, 1921

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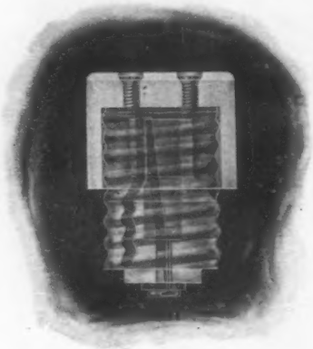

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ROBERT SIBLEY, Editor — H. W. L. GARDINER, Bus. Mgr.

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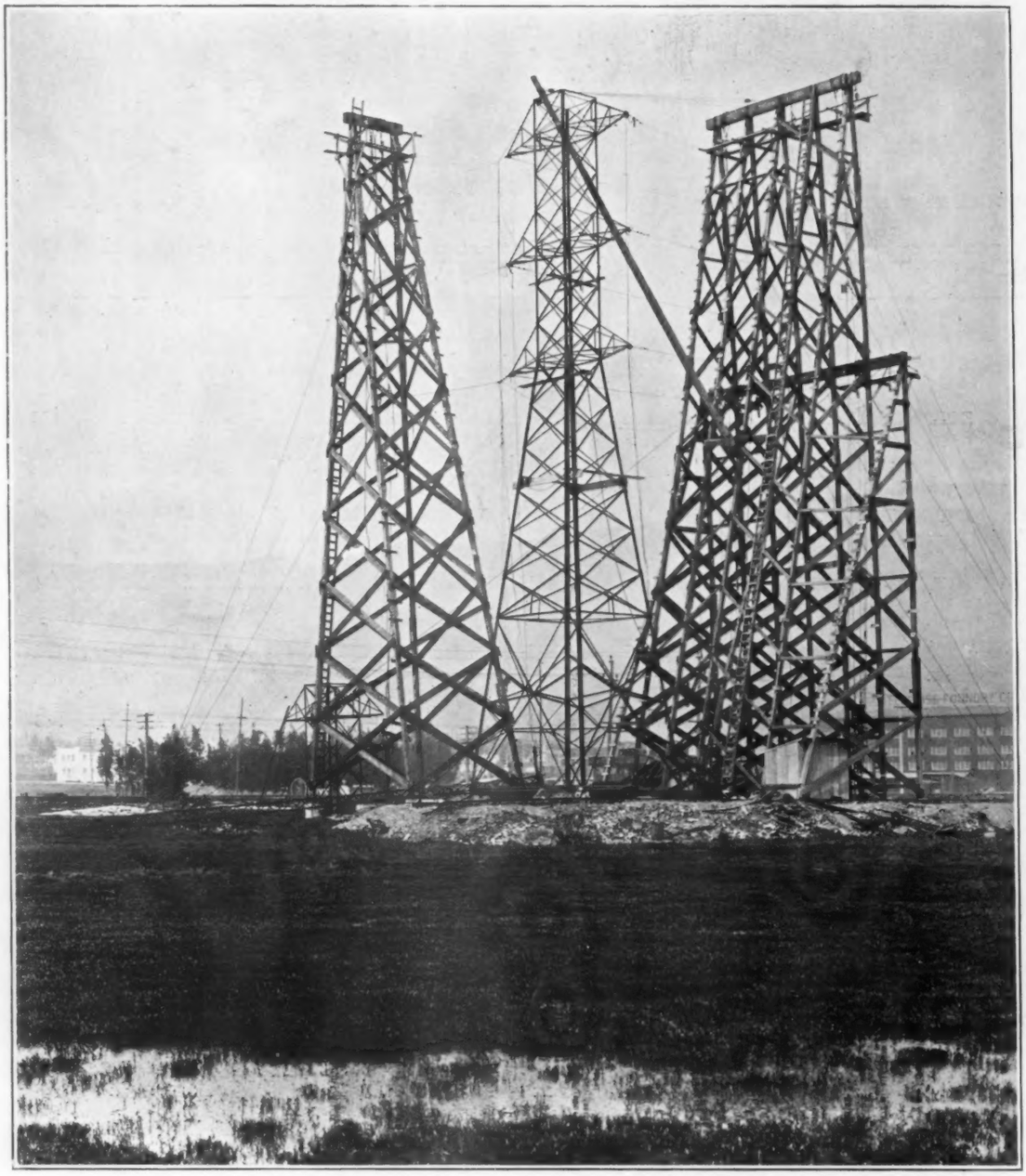

Breaking a World's Record in Transmitting Hydroelectric Energy for the Upbuilding of Industry in the West

TWO HUNDRED and twenty thousand volts is to be used on the new transmission lines west of the Rockies not merely to break another world's record in high tension transmission, but to make possible cheaper power for the industries of the West and its peoples. This super-voltage makes necessary greater spacing between conductors, and consequently higher steel towers to withstand the tremendous strains of the extra heavy wire required in transmitting gigantic blocks of power generated in the mountain fastnesses hundreds of miles from the agricultural and industrial centers of the West. These towers are a western product, manufactured, galvanized and tested by the Pacific Coast Steel Company at their plant in South San Francisco. The tower here shown is undergoing a test consisting of 69,100 pounds applied in a horizontal pull on the cross arms and a vertical loading of 8,400 pounds.

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Journal of Electricity and Western Industry

A publication devoted to the upbuilding of the great industrial West and the countries bordering on the Pacific

A McGraw-Hill Publication

Interpreting Western progress through the application of electric power, light, and heat in industry and in the home

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FOR A GREATER WEST

THOSE who are intimately in touch with the engineering and commercial development of America today realize that west of the Rockies a situation of "empire in the making" exists to an extent not equaled elsewhere in the nation. And yet, when traveling over the various states which constitute this great western empire, one becomes impressed with the fact that western development has thus far been mainly accidental. Industries have been started where they had no business to be implanted and other localities that need these industries cannot get them. To one of broad vision it seems clear that the Pacific Coast needs today more than anything else an accurate survey—disinterested and unbiased—of the resources and needs of each section of the great West.

The Journal of Electricity and Western Industry has already started a move in this direction, cooperating with the Pacific Coast Section N. E. L. A., in beginning an analysis of western industrial conditions. The movement deserves even more wide-reaching consideration. It is a task calling for the attention of the Northwest Electric Light and Power Association and the electrical organizations of other parts of this region. It will probably be necessary for the governors of each of the Western states to appoint a man or men to help in this work, also for the chambers of commerce in principal cities to appoint men that are experts. All of these interests, acting as a body would classify the shipping power, oil, coal, soil, climate and other features of each section in order to determine, first, what each district has to offer; and second, what each district needs the most.

With such a standing committee well posted, an eastern manufacturer proposing to start a plant in the West will receive the following authoritative answer to his question, in no uncertain words: "Your plant should be at Tacoma, or Los Angeles, or San Francisco, or in Salt Lake City, because, etc.," and then emphatic reasons should follow. Such broad vision is not Utopian; it is obvious that the West will never grow intelligently nor will there ever be built up here an empire that will endure unless the various communities composing this vast district quit bickering and fighting for this or that industry or manufacturing plant and come to look upon all the interests of the West as one, starting to build as if it were all one big town or state. Each locality has some advantages which should be exploited properly, whether it be labor, lumber, or something else. Let us determine what these advantages are scientifically, and then all boost together and get the industries of the nation actively engaged in the building of an empire on a constructive basis never before attempted in the history of the world. With this great vision in view, Journal of Electricity and Western Industry is ever working for the upbuilding of a greater West. Are you with us?

Substitute for Competition

It has generally been recognized that it is necessary for a regulatory body to have means within its power of enforcing satisfactory service on the part of the public utilities which it regulates. In certain commonwealths of the West the whip of punishment has taken the form of a threat to permit a competing company to enter the district which the company in the field is failing to serve adequately. The commission acknowledges, in other words, that the best interests of the community are to be found in a well-regulated monopoly without duplication of equipment and overhead, but recognizes, nevertheless, that the community must be served. If one company is not prepared to give this service, what is to be done about it? Fines provide a punishment, but do not necessarily remedy the situation. Public utilities as a whole have met the test well, but in the course of events it is inevitable that the sentence be put into effect—and certainly the inadvisability of a punishment is not to be condoned on the ground that it is seldom applied.

The former president of the California Railroad Commission, Mr. E. O. Edgerton, has a constructive suggestion to make on another page of this issue. He offers as a possibility that where service continues to be unsatisfactory despite repeated warnings, the regulatory body be empowered to call upon the company to cite cause why its operation should not be taken over by the Commission. The time of this receivership would in all probability be limited, and the interests of both the public and the owners, of course, safeguarded.

This is a drastic suggestion, but regulatory legislation has not been less successful in the past because it has been drastic. Certainly the competitive system in the case of public utilities, which punishes the community even more than the offender, is not to be looked upon as a remedy. Why not try another?

Hoover and the Cabinet

Profound interest has been manifested throughout the nation over the appointment of Herbert Hoover to the cabinet of President Harding in the capacity of Secretary of the Department of Commerce. This call to public office comes to Mr. Hoover just as he is in the midst, not only of a great international relief campaign to save some three million and a half starving children of Europe, but also an intensive campaign in this country as president of the Federated American Engineering Societies in the making of a national survey to find out why there are today three million idle men walking the streets in the cities of America.

It is questionable if Mr. Harding has done any one thing thus far that will have a tendency to instil public confidence in his administration more than this appointment of Mr. Hoover to the Department of Commerce. Already a decidedly optimistic tone is being taken in the international outlook. It is understood that Mr. Hoover will insist on the reorganization of this department, the making of the census bureau to function still further in a statistical way for the internal and foreign development of the nation, and the putting of the Shipping Board directly under the activities of the Department of Commerce. The years immediately ahead are unquestionably ones that will be fraught with serious questions regarding the disposition of the foreign commerce of the world, and as to whether this country is to have its proper share in this disposition. Within the great engineering organizations of the country, Mr. Hoover's influence is being exerted in a powerful manner, and the engineer is becoming a most constructive factor in disinterested public work.

It is believed by all forward looking men that the new activities of Mr. Hoover portend much of helpfulness in the way of building up industrial activities of this nation, and the re-establishment of commerce and confidence among the peoples of the world. It is questionable if there are more than five or six other names uttered by the human tongue that are more widely recognized throughout the world than is the name of Herbert Hoover.

And in this wonderful breadth of acquaintanceship only things good and helpful resound in the consciousness of the individual when his name is pronounced.

The Self-Regulation of All Industry

Industry throughout the world is quite concerned with the question of fuel supply, as brought out by Col. David P. Barrows, president of the University of California, at the recent anniversary dinner of the Journal of Electricity and Western Industry. The problem of coal and fuel supply is perhaps the most serious one that concerns Europe today. When we contemplate this situation and with it the remarkably fortunate situation of the states west of the Rockies, where 42,000,000 hp. awaits development from our natural water resources, we can well agree with J. U. Calkins, governor of the Federal Reserve Bank, Pacific Division, who recently stated before the San Francisco Electrical Development League, that in the states west of the Rocky Mountains the development of hydroelectric energy has only begun.

When, however, we begin to talk in units of world-wide development, we must broaden our horizon in our daily thinking and in such broadened horizon we shall see that we must establish order in all parts of the world, for we cannot live as we should if starvation is staring half the people of the world in the face; and this brings us to the situation that the stability of world commerce cannot be maintained unless there is a clear relationship between the retailer and the producer. In other words, unless voluntary or else compulsory regulation of all industry be put into effect.

It would seem that the magnificent manner in which utility regulation has been worked out, particularly in the commonwealths of the West, and the open and above-board statements of the business status of these great institutions, present to the business world of today the best operated business institutions to be found. And this would lead us to the conclusion that all business might well look within itself, examine itself voluntarily, and by self-regulatory bodies, as it were, bring about a better situation than exists today in industry throughout the world.

The slogan that Vice-President Coolidge so aptly stated, that the new governmental regime at the national capital will have for its motto, "Less government in business and more business in government," would lead clear thinking minds to carry on this self-investigation of business enterprise, and if it is pursued with earnestness and sincerity there is no question that much of the stability of industrial affairs throughout the world today will be vastly bettered.

The West Leads the Way Again

New York is credited in a news item on another page of this issue with following a California example in the matter of abrogating municipal franchise contracts where the rates may prove unjust. This is true, to be sure, but unless she may read of it in these columns, New York continues to be unconscious of the fact.

At the very beginning of regulation in California in 1912 contracts were disregarded and rates fixed as though no contracts existed. From that time to this it has been the uniform practice under regulation, wherever contracts fixed rates either discriminatory as to other consumers or unreasonable as to the owners of the utilities, to proceed as though contracts had not been made. This holds true even as to contracts made before the state exercised its right to regulate contracts.

This practice has been sustained again and again by the courts, both federal and state, one of the very recent decisions being by the United States Supreme Court. Also, rates have been raised on street car lines in cities notwithstanding franchise provisions limited the fare to five cents.

Both as to contracts and franchises, the underlying conception permitting state regulation is that

when such franchises were granted and contracts made, the state had the power to regulate even though this power was latent, and whenever the state saw fit to exercise its power of regulation both the franchises and contracts should be read as though they contained a provision setting out the power to regulate.

It is surprising for us out West now to read that in New York this subject is being discussed as though it were a new conception, and that if it be concluded in New York that contracts and franchises are binding as against state regulation, this will affect the whole country. The fact is that in the West the precedent is now fixed in favor of state regulation over contracts and franchises, and it is probable that the East will find the only solution to be that already arrived at in the West.

Still Advertising "Socket Appliances"

No electrical man questions the value of the convenience outlet. No electrical manufacturer fails to realize that his welfare is dependent upon the wider use of the base receptacle in contrast to the lamp socket as a connection for larger appliances. And yet a perusal of the advertisements appearing in the popular—and to a great extent even in the technical press—would lead one to believe that this conviction had not penetrated as far as the advertising man. Almost all appliance advertisements are illustrated. And almost all of these illustrations portray the washing machine, or the vacuum cleaner, or the electric iron, as the case may be, with a screw plug at the end of its cord, inviting insertion into the nearest lamp socket. The familiar two-pronged convenience outlet plug is no less artistic in appearance and in addition connotes the idea of a base receptacle conveniently at hand. This is a suggestion toward a first step in the extensive convenient outlet advertising campaign which is being urged among all national advertisers of electrical ware.

A New Method of Choosing Chimney Heights

The proper height of a chimney is determined by a consideration of the draft required to bring about the most economical condition of combustion in the furnace. Since the prime function of a chimney is to pass out into the atmosphere the gases resulting from combustion of the fuel, it is quite evident that the weight of the flue gas passing per second or per hour depends for practical purposes upon two things: first, the weight of the fuel burned, and second, the per cent of excess air used in burning it.

On another page of this issue will be found a comprehensive table and diagram whereby the chimney height may be ascertained very readily. In the issue of the Journal of Electricity for October 15, 1920, there appeared by the same two authors a discussion of draft required in fuel oil practice. It was there shown that for an oil fired boiler to operate at 200 per cent of its rated capacity connected to a chimney through a flue 100 ft. long and containing two right angle turns, a draft of 1.05 in. is required. From the data contained in the article of this issue we see at once that the size of the chimney required to produce this draft may be determined quite easily. Thus, let us suppose that we are considering an installation of 2,500 hp.; referring to this article we see that at 200% of rating there will be 5,000 hp. actually developed and the quantity of flue gas produced by the oil fires will be 5000×60, or 300,000 lb. per hour. From the diagram we find that a chimney for this capacity should be 102 in. in diameter. We may assume that at the capacity considered the average temperature of chimney gases will be 600 deg. F. Referring to our diagram we find that the draft for a chimney 102 in. in diameter and 100 ft. high with 300,000 lb. per hour of flue gas is .525 in. for 500 deg. F. and .63 in. for 700 deg. F. Interpolating we have a draft of .58 in. for a temperature of 600 deg. F. Since the draft required is 1.05 in., the height of the chimney must be $100 \times \frac{1.05}{0.58}$ or 181 ft. This is the height of the chimney above the point at which the flue enters. If the flue enters the chimney 14 ft. above the ground, then the total height of the chimney must be 195 ft.

The ease and facility with which the design of the chimney may thus be ascertained in height and diameter will commend the use of these tables to engineers generally throughout the West.

Raising of Dues In Engineering Societies

The American Society of Civil Engineers has recently decided to raise its annual dues for Society membership from the basic rate of $15.00 to $20.00. At the recent December meeting of the American Society of Mechanical Engineers it was decided for the present not to raise the dues of the members, but rather to put into effect a small curtailment of six per cent in all of the activities of the Society in order to keep expenses of the budget within the income of the Society.

The present seems no time for the raising of dues, although when the immediate depression is over, enlarged activities of national engineering societies might prove so helpful as to justify the increase. Meanwhile, the effect of the increased dues upon the membership of the Civil Engineering Society will be watched with great interest.

Prune Rates and Western Industry

There have been instances of the difference of one cent in unit transportation costs determining the moving of an industry from one side of the continent to the other. The tremendous readjustment of prices which resulted in the present increased freight rates both on the railroads and in shipping has been reflected in many ways in western industrial development. Its ultimate effect, balancing the loss to such industries as the lumber industry against the gain in the numerous eastern factories which have established branches on the Pacific Coast, has not yet been exactly determined.

Falling prices are now presenting problems of equal importance, which in all fairness to the industries of the West must be viewed from the standpoint of their far-reaching effects upon western development as well as upon their immediate application to the situation in hand. Such a case is that now before the Shipping Board relative to the differential rates to be charged for prunes packed in boxes and those packed in sacks. The situation is interesting from the standpoint of the precedent established.

It seems that back in the dim ages of western development when the humble prune did not yet appear upon the menu of our leading hotels, the steamship companies came to the conclusion that prunes packed in boxes were easier to handle than those packed in sacks and in consequence deserved a lower freight rate. Thereupon was established the differential rate in favor of the boxed product, under the friendly protection of which the prune industry has grown up on the Pacific Coast.

Now the prune growers, as well as others, have suffered from high freight rates and diminished market prices and find themselves this year with an uncomfortable proportion of last year's crop still on their hands. As a happy solution of the difficulties, the California Prune Association succeeded in obtaining from the steamship companies a reduction in the rate of shipment for sacked prunes which would enable them to place prunes upon the eastern market at a much less price. Incidentally, the rate was materially below that allowed boxed prunes.

It was only later that the far-reaching aspects of the case appeared. The difference in shipping rates between the packed and unpacked product is sufficient to make profitable the transference of the prune packing plant of the Association from the Santa Clara Valley to New York. The loss to California in this industry alone with all its requirements of box wood, labels, nails and the thousand and one items of machinery, labor and power use, is of tremendous importance to the state. In addition, it is obvious that if this rate is a just one as regards the prune industry, it is equally fair that raisins shipped in bulk should go at a lower rate than when packed—and so on, down all the line of the western packing industry.

There have been many arguments in the controversy—among which, incidentally, it does not appear clear why the lower rate should have been granted the poorer container—but the moral which concerns western industry as a whole is the necessity for a far-sighted policy even in meeting emergencies. Nobody begrudges the prune growers their lower rate, but it is to be hoped the decision will recognize the eventual rather than the immediate good of the industries of this district.

How Everyone Can Help

The Journal of Electricity and Western Industry is now engaged heart and soul, to even a more intensive degree than ever before, in the upbuilding of the West. Every reader of these lines can help very vitally in making this great empire west of the Rockies come into its own by constantly calling to the attention of the editors of this journal unusual and helpful features that are now under way which go toward giving an optimistic, enthusiastic and helpful spirit of enterprise in this matter of empire making. We are in search of suggestions relating to anything and everything that can help to upbuild the West and unlock its magnificent undeveloped resources, particularly suggestions as to water power, so long as they are written in a language that the business man can understand.

In addition to the upbuilding of the engineering, industrial and commercial organizations in the West, we hope by taking a lead in vision, and by the reporting and describing of accomplishments and by the pointing to a better way in language the business man can understand, to hasten the day when the great West, facing as it does the countries that line the Pacific, now occupied by over one-half the peoples of the world, will come into its own and build here the last great empire of the world, which in helpfulness to mankind, and the prosperity and happiness of its citizens, will surpass any that has ever existed. Only, however, insofar as the vision of its citizens is put to print and carried far and wide, can this be accomplished, and each and everyone throughout the West may have a part in this work by calling to our attention some of the wonderful things that each day come within his experience. For "without vision the people perish."

A NEW JOURNAL SERVICE

Would you be willing to carry 5400 5-gallon cans full of water up a ladder 16½ feet high every hour for three cents an hour? You would not, nor would anybody else in this country. Yet that is what is necessary to generate one kilowatt per hour. Did you ever try to explain it to a disgruntled consumer in that way?

Most of the men in the electrical industry realize that the new high voltages of 165,000 and 220,000 are put in because they are the most economical, but could they justify this action in words that would be understood by the man in the street? Why these high voltages were chosen is explained in simple language in an article by a prominent western engineer in this issue of Journal of Electricity and Western Industry. This will probably give you some new ideas on the subject. It is our intention to publish in Journal of Electricity and Western Industry, from time to time, explanations of various engineering problems and existing conditions in simple language, written by leading western engineers. This new series will be of benefit not only to the men in the industries which use electricity, as it will clear up in their minds many doubts concerning the generation, transmission and uses of electricity, but it will also be of use to power company employes, giving them simple examples and analogies which they can use in explaining these things to the consumers with whom they come in contact.

LOS ANGELES MANUFACTURES FOR 1919 GIVEN OUT

Figures on Los Angeles manufacturing enterprises show an encouraging increase in the past five years according to figures of the 1919 census which have just been given out. Totals on the most important of these items are given as follows:

INCREASE IN LOS ANGELES MANUFACTURERS, 1914-1919

	No. Establishments	Capital Invested	No. Wage-earners	Value of Output
1914	1911	$101,681,000	23,744	$103,458,000
1919	2543	158,861,000	47,138	279,327,000
Percent increase, 1914-1919	33.0	56.2	98.5	170.

Wages increased 202% over the 1914 figure, salaries 115.8%. The number of salaried employes showed an increase of 59%, as against a 98.5% increase in the number of wage earners. The total value of products increased 170%, the value of raw materials growing by 171% and the value added by manufacture increasing 168.7%. The number of proprietors or firm members engaged in manufacturing enterprises increased 42.6% over 1914.

The figures in general show a tendency toward larger establishments, the number of wage earners increasing at almost three times the rate of the number of establishments. It is encouraging also to find that the value of output in relation to the capital investment maintained a similar ratio, the 1919 manufactured products amounting to 170% more in value than in 1914, while the capital involved increased at the lesser ratio of 56.2%.

NEW YORK PLANS FOLLOWING CALIFORNIA EXAMPLE

A public utility question raised by the city of New York in its opposition to the bill recently introduced into the legislature at Albany through the activities of Governor Miller, is of particular interest in the West where questions of a similar nature have been familiar subjects of discussion. The city, which has $250,000,000 of its own money involved in rapid transit subways operated by private companies, has employed Hiram Johnson to fight the proposed legislation, by which a commission would be empowered to settle rates irrespective of franchise contracts of the city with the operating companies.

The transit relief legislation recommended by Governor Miller contemplates the unification of the rapid transit and surface lines of Greater New York under compulsory city ownership with private operation at a single fare to be fixed by the commission created by the new legislation. The city contends that its contract with the operating companies calling for five cent fares would be violated if the legislation is put through, and that the decision has a bearing on every contract made in the United States.

Johnson is prepared to put up a vigorous fight on behalf of the city, and announces that he will issue daily bulletins dealing with the state of health of the pending traction bills, the series to be entitled "New York's Traction Tragedy."

The legislators, however, at a trial vote, showed that they favored the bills. Although there are a number of additional provisions in this legislation, should the principle with regard to utility regulation be accepted, New York will be following the precedent established by the California State Railroad Commission at the very beginning of its administration, whereby the regulatory body fixes rates according to an established code of fair return, quite irrespective of any city franchise or contract by which the operating company would be restricted to a five-cent fare or entitled to a ten-cent fare.

INTEREST OF MANUFACTURERS, JOBBERS, CONTRACTORS AND CENTRAL STATIONS IN BETTER LIGHTING

This chart on the unit cost per kw. of lighting load installed is based on an installation of twenty-eight 300-watt units and was prepared for the San

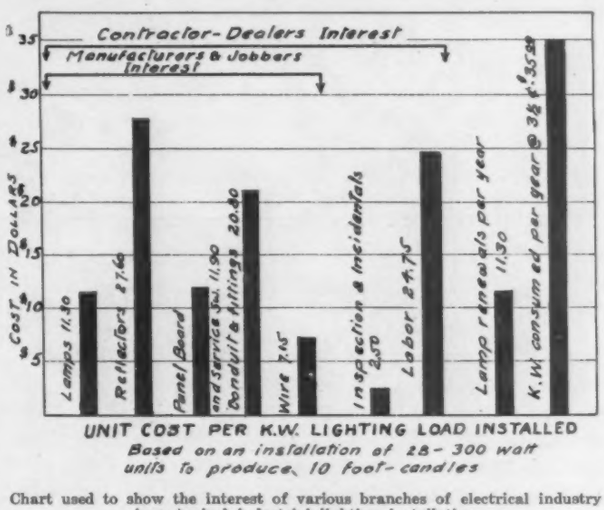
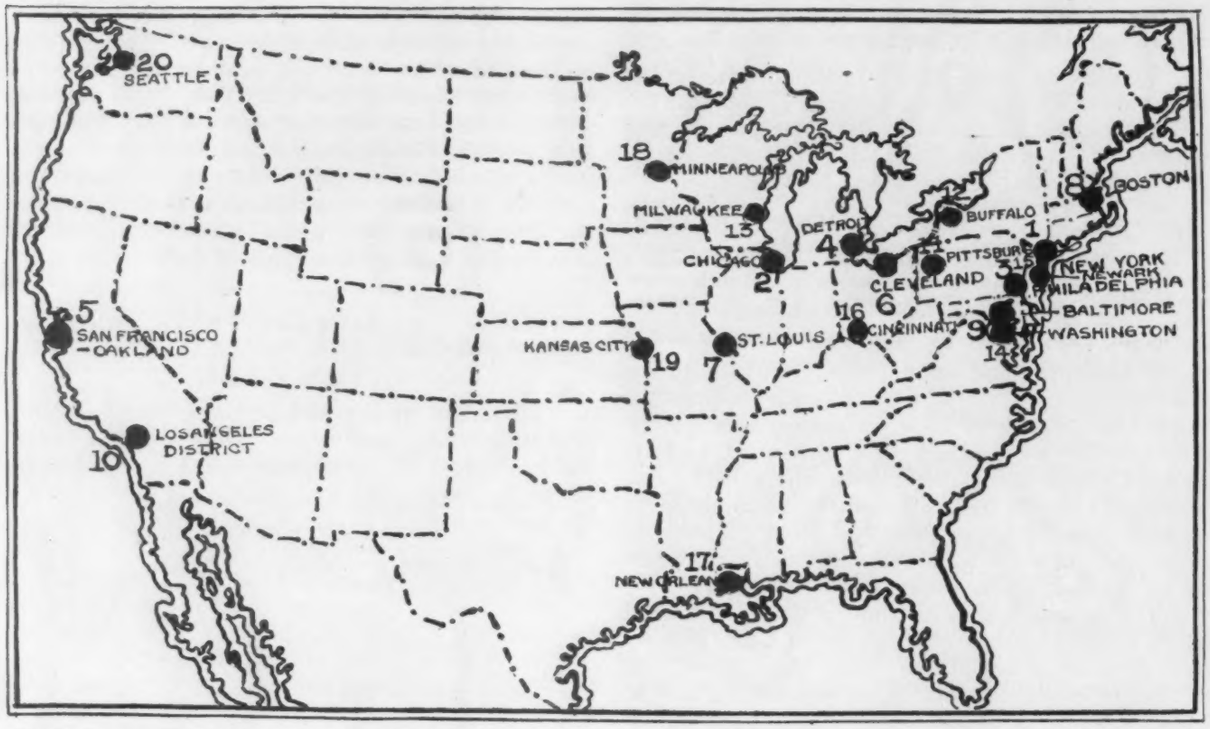


Chart used to show the interest of various branches of electrical industry in a typical industrial lighting installation

Francisco Electrical Development League by Earl E. Brown, of Brown-Langlis Company, and G. A. Anderson, sales manager of the Electric Appliance Company, to show why the various branches should support the campaign for better industrial lighting. The manufacturers are interested to the extent of $78.75 and the jobbers to a like amount as that is the list cost of the materials that enter into an installation of this size. The contractor is interested to a like amount and added to that, $27.25 for labor and incidentals. As the life of a lamp is rated at one thousand hours and that is the average time a lamp is burned each year in an industrial plant, the lamp renewals are equal to the original cost of the lamps each year, or $11.30. Using an energy charge of 3½c. per kw-hr., the revenue to the power company per year is $35.00 in addition to the extra energy consumed by the motors in the industrial plant, which under better lighting conditions will be used more, having been shown that an increase in the amount of light in an industrial plant will result in an increase in production. Charts of this kind should be prepared to show all branches of the industry their interest in the various exhibits which are held and in the regular sale of merchandise.



Map showing the twenty largest cities in the United States, numbered in the order of their population. Three are already on the Pacific Coast.

WHERE THE POPULATION CENTERS

The foremost twenty cities of the United States from the standpoint of population are here listed on the basis of the 1920 census.

In order to visualize more justly the actual centering of metropolitan areas, the two California centers have been treated as districts, San Francisco figures being combined with those of Oakland, Alameda and Berkeley and listed as the San Francisco-Oakland district, and Los Angeles being credited with Pasadena and Long Beach and listed as the Los Angeles district. It is realized that there are certain other cities which have closely related metropolitan areas which should also have their population figures enhanced to this extent, but it is felt that this injustice is slight and the present listing really presents a more just picture of actual conditions. The list follows:

		Population 1920	Increase 1910-20 Per Cent
1.	New York	5,621,151	17.9
2.	Chicago	2,701,705	23.6
3.	Philadelphia	1,823,158	17.7
4.	Detroit	993,739	113.4
5.	San Francisco-Oakland district	809,463	28.3
6.	Cleveland	796,836	42.1
7.	St. Louis	772,897	12.5
8.	Boston	748,060	11.6
9.	Baltimore	733,826	31.4
10.	Los Angeles district	677,599	84.1
11.	Pittsburgh	588,673	80.7
12.	Buffalo	506,775	19.6
13.	Milwaukee	457,147	22.3
14.	Washington	437,571	32.2
15.	Newark	414,216	19.2
16.	Cincinnati	401,247	10.4
17.	New Orleans	387,219	14.2
18.	Minneapolis	380,582	26.3
19.	Kansas City	324,410	30.6
20.	Seattle	315,652	33.1

NEW TESTS TO BE MADE ON RADIO PHENOMENA

Following up a series of tests conducted during October, 1920, and January, 1921, the American Radio Relay League and the Bureau of Standards will cooperate in new tests to be made in April for the purpose of determining the cause of varying intensity in radio signals. When radio was first used for long-distance communication, it was noticed that signals were not transmitted as far during the day as during the night, and also that night signals using the shorter radio waves vary greatly in intensity from minute to minute. Since the introduction of radio direction finders it has been learned that great variations may occur in the direction of radio waves as they arrive at the receiving station during the transmission of signals from a given transmitting station. In the tests being conducted, from five to ten radio stations transmit signals in succession, these being received at about one hundred receiving stations which record the variation in the intensity of the signals as received.

Varied theories have been put forward, based on a statistical study of collected results of experiments, one being that fluctuations are probably caused by irregular absorption of the waves by masses of slightly ionized air through which the waves travel in their course. The fading phenomena are closely associated with the atmospheric disturbances which affect all radio communication. The experiments are providing the investigators with valuable data from which to obtain reliable averages.

Improving Laws Concerning Regulation of Public Utilities

The Former President of the California Railroad Commission Gives Practical Suggestions for More Efficient Regulation. Suggests Regulatory Bodies Act as Receivers for Inefficient Utilities.

BY E. O. EDGERTON

[The West owes much of its electrical prosperity and industrial development to the high standards of public utility service which characterize its activity, and which have been so intelligently promoted by its regulatory bodies. The problems of public utility regulation and possible solutions of some of them are brought out in the following article where enlarged powers are suggested for the regulatory bodies. The author is the former president of the California Railroad Commission, known nationally as one of the most helpful figures in present day utility regulation.—The Editor.]

IT may be profitable at this time, after years of experience under existing laws providing for the regulation of public utilities, to consider such changes in these laws as will improve and perfect regulation.

Much of the discussion of public utility regulation involves the functioning of public utility commissions rather than changes in existing laws. It is true that those who have agitated against state regulatory bodies have, as a rule, urged changes in the public utility acts, usually by way of restricting the powers of the commissions. We may at once dismiss consideration of restricting the powers of commissions as being a distinct backward step adversely affecting the public and the companies.

Where a commission is restricted within narrow limits, invariably it is found that the public complains because of its inability to get results which are desirable, and the enlightened public utility executive frankly admits—in fact he usually contends—that a commission with limited powers is not in a position properly to protect the vital interests of the companies.

Every investigation of state regulatory bodies has demonstrated that what might be called the standard provisions of the large majority of public utility acts have proven sound and are generally accepted. Briefly these provisions may be summarized as those which give the commissions complete control of service, rates, issuance of stocks and bonds, extensions of facilities for giving service, additions and betterments to plant, joint use of facilities by separate companies and power to prevent competition.

Value of Experience in Regulatory Work

One very important change in existing laws which in my judgment should be made is that instead of elective or appointive commissioners for a limited term, the commissioners should be appointed with no limitation of term except during good behavior and possibly age limitation, much as the federal judges are now appointed.

The task of regulating public utilities has become a highly developed specialty, and the public invariably suffers when it loses the services of a trained and experienced regulator who is usually succeeded by an inexperienced man who cannot function with full efficiency until after years of study and experience. In my judgment, there is no greater evil in regulation than a commission whose personnel is constantly changing and with exceptions, even under the present appointive scheme for a limited term, the older and more experienced commissioners are constantly leaving public service.

When it is considered that the matters passed upon by state regulating bodies involve huge sums of money and affect in a very vital way the comfort and convenience, and in a considerable measure the prosperity of the entire population of states, it may readily be concluded that the office of public utility commissioner is one of the most important in state government.

The scheme of electing commissioners by popular vote for limited terms has proven seriously defective. Theoretically it sounds attractive to say that in a democracy important public officials, such as utility commissioners, should be made responsive to the public will by frequent opportunity on the part of every citizen to cast his vote in the selection of this officer. But practically it has been found that the election of commissioners by popular vote is a clumsy and indirect method of submitting to popular decision the orders of a commission.

This is utterly unfair to the public because of the impossibility adequately to present all of the facts, and calling upon the citizens to form a judgment on the highly complicated problems constantly passed upon by the commission.

By appointing commissioners for an unlimited term with adequate salaries, this work could be made a career, and able men could be found who would devote their entire time and energies to a proper solution of the many perplexing problems which arise.

Checking Over-Capitalization

Another change which might well be seriously considered is to give commissions power to compel decapitalization of companies whose outstanding issues of stocks and bonds are topheavy and burdensome. One very serious handicap to proper regulation exists where companies are heavily over-capitalized, having issued stocks and bonds prior to state regulation, and while commissions do not authorize rates which will support this over-capitalization, nevertheless, the very vital thing of credit of such a company is affected by this condition and the commissions are helpless to improve this credit except, perhaps, by a very slow process of forcing reinvestment of earnings which gradually builds up assets under existing securities. If a commission were empowered to call a utility company before it and say: "You must immediately reduce your capitalization so that the remaining securities will be recognized as sound," it would be of undoubted advantage to the public and the owners of the company. There would

be no reduction of the value of property. It would merely mean that existing security holders would have their evidences of indebtedness, such as bonds, or evidences of ownership, such as stock, reduced in nominal or face value but in fact their securities would more equally approach the real values which existed. I am convinced that within a brief time after decapitalization the creditors and owners of the properties would be definitely better off in that they would have sound securities with a greater market value than those they had relinquished.

The Commission as a Receiver

The commissions should be the receivers of bankrupt public utility companies. By a wide margin the commissions are better equipped to take over and temporarily manage insolvent companies than the courts. A commission could take over an insolvent company, completely reorganize it, prescribe a sound issue of securities to be supported by a proper schedule of rates, and turn the property back to the owners at a very much less cost and in very much better condition than results from the present court receivership.

I would go one step farther and empower commissions to take over any public utility company which after proper procedure and with reasonable safeguards the commission found was substantially failing to serve the public. Of course, I do not mean that this should be done upon any minor failure on the part of a company, but only where there is a substantial continued inability or refusal adequately to give service.

Probably it would be wise to hedge this power about with such conditions as the requirement of a probationary period. For instance—the commission could officially warn a company that it was not adequately serving the public, specifying with particularity a period after which if improvement was not made by the company the commission would issue a citation to show cause why the property should not be taken over by the commission temporarily to be managed in the interests of the public and the owners. Possibly a time limitation should be put upon the management by the commission and of course the constitutional rights of the owners should have proper protection.

A public utility should have the right to petition the regulating body to declare a receivership and take over and operate the property under the same conditions as where involuntary receivership occurs.

This would make it possible to relieve intolerable conditions surrounding some public utility operations such as the tractions. Upon the declaration of such a voluntary receivership the regulating body should be empowered to relieve the utility of burdensome requirements placed upon it by municipal governments and should also be empowered to reduce or readjust service to any extent necessary to enable operation to continue.

Full Power Necessary for Commission

In any change in public utility acts the purpose should be fully to empower commissioners adequately to regulate in the interests of both the public and the owners, and to throw the full responsibility for results upon the commission.

It is now demonstrated that where commissioners are free to devote themselves to regulation unhampered and undiverted by political considerations they have made regulation a success, and the utility owners under such conditions have been found as a rule willing to submit to regulation in the confidence that they will be fairly and intelligently dealt with.

NEWSPAPER TAKES UP CAUSE OF HYDROELECTRIC DEVELOPMENT

One of the California daily newspapers has taken up the cause of hydroelectric development by the corporations and is devoting a full page to the question regularly. Not only in the news section is this subject being brought to the attention of the

State of California Faces Great Power Shortage

Population Increased Forty Per Cent in Ten Years; Demand For Service Gains 300 Per Cent

First Warning of Real Danger Came During the Great War; Crisis Apparent Last September

One Answer of the San Joaquin Light and Power Corporation to California's Demand for More Power

Full page of San Francisco Chronicle which is helping educate the people to the actual conditions entering into hydroelectric development and the part it plays in the development of the industries of the West.

people, but also in the editorials. One of the recent editorials said in part:

"California has plenty of water power, but mostly going to waste. The development of hydroelectric power in California has boosted industry on every hand. But industry, agricultural and manufacturing, has caught up with its power supplies. If it is to go ahead it needs more power. Force of circumstances as well as economic logic demands that more water power be harnessed. We are obliged to depend upon private enterprise for this development. Common sense, then, urges that private enterprise be relieved of hampering restrictions and in every way encouraged to go ahead.

"The situation is not commonly understood. Development now must turn to the big projects on the large streams. These will take a great deal of capital and this cannot be had unless there is assurance of a fair return and safety for the investment."

Pit River Falls, which will be utilized by the Pacific Gas & Electric Company in developing its 320,000 kw. Pit River project.

The Development of Pit River

BY A. H. MARKWART

(The industrial demand for electricity is a primary cause of the great hydroelectric activity which is now in progress in the West. The new developments are conceived on a large scale and calculated to utilize to the utmost the available water supply. Following is a description of one of the most important, by the director of engineering for the Pacific Gas & Electric Company, in a paper presented at the recent meeting of the San Francisco Section A. I. E. E. —The Editor.)

The Pacific Gas and Electric Company believes that its prosperity, and the prosperity of all parts of the territory it serves, is dependent upon an ample power supply, and it is doing its part to meet the needs of its consumers.

A study of the kw-hr. output of this company from 1911 to 1920, inclusive, reveals a growth of about 100%. If this growth continues, and after making due allowances for increases resulting from the acquisition of various electrical properties, this increase carried forward indicates that the output, which was almost one and one-half billion kw-hr. in 1920, will be about three billion kw-hr. in 1929. An inspection of the load factors of the past shows that the 65% which has been attained is not likely to be exceeded in the immediate future. Using this load factor in connection with future growth, the average and peak loads which were 168,000 and 259,000 kw. in 1920 will be 343,000 kw. and 526,000 kw., respectively, in 1929. The company intends to provide sufficient production, transmission and distribution facilities to satisfy the demands which may come upon it as nearly as these may be determined by the growth in the past. To do this there is under way the comprehensive development of Pit River.

Topography of Pit River Basin

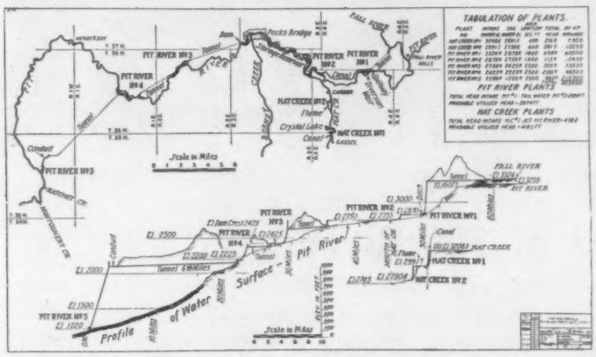
This unique river drains a basin of about 6,000 square miles, lying in Modoc, Lassen, Siskiyou and Shasta counties. Its principal tributaries are Fall River, Hat Creek, Burney Creek and McCloud River. Generally speaking, the basin is of volcanic structure, consisting of areas of mountains, porous lavas and plateaus, having varying amounts of precipitation. Roughly, the plateaus receive from 14 to 18 inches, the lava areas from 18 to 34 inches, and the mountains from 30 to 60 inches, the maximum obtaining in the mountainous region on the headwater of the McCloud River. The run-off is a minimum in the plateau areas and a maximum in the mountain areas. Although the porous lava areas and the mountain areas produce the bulk of the flow, the former is under much better regulation, as might be expected. In fact, the basin, with respect to run-off, which is relatively uniform, is unlike the usual California streams, the only resemblance occurring in the case of the McCloud. On a recent trip into the region it was observed that during several days of comparatively heavy precipitation, Hat Creek, Burney Creek and the Pit River below Fall River Mills, showed no appreciable rise. Altogether the Pit River is remarkable for its natural regulation, this being brought about by the existence of the many springs and subterranean flows originating in underground reservoirs occurring in the porous areas of Fall River, Hat and Burney Creeks. Curious conditions prevail, as for example: From a study of Fall River at Fall River Mills, it appears that the 1912-13 seasonal run-off of 1,020,000 acre-feet, which is equal to 28 inches per year, over the apparent drainage area of 676 square miles, exceeds the average annual precipitation by 4 inches. From this it is apparent that there are large flows into the Fall River drainage from areas outside.

Projected Development

The Pacific Gas and Electric Company contemplates the full development in the basin from a point on Fall River above Fall River Mills to a point on the Pit below the "Big Bend," a distance along the streams of 60 miles. The total fall is 2104 feet, of which it is expected to utilize 2074 feet in at least five plants. The total continuous power is computed at 320,000 kw., requiring an installed capacity of upwards of 450,000 kva.

The area of the watershed above the diversion

of the last proposed plant is 4809 square miles. The observations of the past ten years show the minimum daily flow to be 2,010, and the maximum 13,300 second-feet. It is tentatively proposed to install a storage reservoir at a point below Pecks Bridge, of sufficient capacity to regulate the river below to such a flow as may be desired. Mass curves indicate that a storage of 62,000 acre-feet will regulate the river to 2500 second-feet in all but exceptionally dry years. It may appear that when surveys now under way are completed further regulation will be possible. Above this reservoir will be two plants, one of which is now under construction—Pit River No. 1, described later — the upper plant receiving Fall River water, an average low flow of 1400 second-feet; and the lower plant, this 1400 second-feet and additions from the Pit making a total average low flow of 1500 second-feet.



Diagrams of the Pit River development scheme showing the location and elevation of the various plants, and the manner in which the water will be utilized. The horsepower available for each is also given.

In addition to the development of the Pit, two plants are now going in on Hat Creek. These will utilize substantially all the drop existing from Hat Creek Valley to the Pit. Hat Creek No. 1 will receive 400 second-feet average low flow, which flow is largely from Rising River, whereas the flow through Hat Creek No. 2 will be increased to 600 second-feet, largely by contribution from Crystal Lake and Rock Creek.

The construction program of this company should call for the expenditure of upwards of $90,000,000 in the next ten to thirteen years to develop and transmit Pit River power to the bay region, and when the arrangements are completed there will be rendered available 3,000,000,000 kw-hr. per year, or twice the energy which was delivered to the system in 1920.

Engineering Features

A brief statement of the general engineering features of the plants now under construction follows:

Hat Creek No. 1 —

The diversion is by means of a timber and rock fill crib dam. The structure is on Hat Creek at Cassel Post Office, and is carried diagonally across the stream to give a longer spill crest, a spillway 180 feet long being provided and water control effected by motor operated radial gates. Connecting the diversion dam and the forebay is a ditch 2750 feet long, having a bottom width of 17 feet, a width at water surface of 45.5 feet, and a depth of 9.5 feet, terminating in a small forebay which has a capacity of only 12.5 acre-feet. The penstock consists of a riveted pipe 1700 feet long, the diameter ranging from 10 ft. at top to 8 ft. at the bottom, having a 7½-ft. turbine inlet. The maximum drop is 216.8 feet from head water to tail water.

The power house, which is a reinforced concrete structure, contains 1—15,000-hp., 225 r.p.m. vertical turbine direct connected to a 12,500-kva. generator. With 450 second-feet of flow, this unit will develop 6650 kw., the effective head for this condition being 212.8 feet. The maximum power which it is considered will be developed will be 9300 kw. when 600 second-feet is being delivered to the turbine. The effective head for this condition is 210.5 feet. This generator is excited by a separately driven current generator. Future plans contemplate an increase in flow of Hat Creek which will be of benefit to both of the plants on that stream.

The power from Hat Creek No. 1 is transmitted over a single circuit 6600-v. transmission line to Hat Creek No. 2 without transformation, the conductors of this line being 500,000 c.m. concentric laid copper cable. Suitable lightning arresters are installed at both ends of this line.

The comparatively long penstock of Hat Creek Power House No. 1 required installation of a pressure regulator which will discharge approximately 80% of the full flow of water.

Hat Creek No. 2 —

The diversion dam for this plant is just below Hat Creek No. 1 and consists of a pile and timber structure, placed diagonally across the stream at a point immediately above Hat Creek Falls. Owing to the existence of a lava talus opposite the entrance of the conduit, a diversion structure at right angles to the stream was deemed advisable. A spillway 282 feet long is provided. From the diversion to the head of the penstock, a timber flume has been built for 4,469 feet on a bench excavated by means of teams and scrapers.

The flume is of timber, 16 ft. 3½ in. by 7 ft. deep, in cross section, and carrying at this depth, 800 cubic feet per second at the grade of .7 ft. per 1000 feet. The flume terminates in a concrete lined forebay which is equipped with radial gates as provided at the forebay of Hat Creek No. 1.

From the forebay water is carried to the wheel by means of a riveted steel penstock 400 feet long, approximately the same size as the penstock used at Hat Creek No. 1 plant.

The power house equipment is identical to that provided for Hat Creek No. 1, with two exceptions; transformers are added to raise the generator voltage to the present line of 60,000, and the pressure regulator and stop valve in the penstock are omitted due to the very short line of penstock.

More power will be obtained at Hat Creek No. 2 due to the inflow from Crystal Lake, which enters Hat Creek between the two plants. Under a normal flow of 600 second-feet, 8,630 kw. will be developed

under an effective head of 195.8 feet. The maximum power which will be developed is 11,200 kw. with an effective head of 194.5 feet and a flow of 800 second-feet. Energy from Hat Creek No. 1 is transmitted to Hat Creek No. 2 at the generator voltage of 6600, and there the output of both plants is stepped up to 60,000 for transmission to Cottonwood, where it is to be delivered to the reconstructed Northern California line for transmission farther south. This line voltage will be increased later to 110,000 and finally to 220,000.

Four 8,000-kva. water cooled transformers are located at Hat Creek No. 2, wound to operate at 63,500 or 110,000 volts.

Pit River No. 1 —

Owing to the size of the generating units, Pit Plant No. 1 is perhaps the most interesting, as the two 35,000-kva. units will be exceeded in size only by the 45,000-kva. generators under order for the Canadian Niagara Company.

The diversion in this case will be on Fall River about three-quarters of a mile above Fall River Mills. The diversion dam tentatively decided upon will be a pile structure of the same general design as provided for Hat Creek No. 2, the idea being to replace it later by a concrete structure. Storage is not provided and the whole minimum flow of the river will be diverted through 1150 feet of open cut and 10,160 feet of tunnel, terminating in a combined surge chamber and spillway. The open cut will have a bottom width at intake of 50 feet and a depth of 10 feet, with a width of 70 feet of water surface, these dimensions reducing to a 12-foot bottom width at the tunnel with 52 feet top width and depth of 20 feet. The tunnel will have an area of approximately 154 square feet and be constructed on a grade of 3 feet per 1000 feet, having a capacity of 1800 cubic feet per second. In general, the tunnel will be of horseshoe section, concrete lined, having a height of 14.3, with a bottom width of 11 feet.

The two penstocks leading to this plant will be a combination of riveted and lap welded steel pipe 1400 feet long, with diameters running from eleven to nine feet.

The station will contain two vertical turbines of a maximum capacity of 40,000 hp., each connected to a 35,000-kva. generator, running at a speed of 257 r.p.m. With 1500 second-feet flow, and an effective head of 429.3 feet, 64,500 hp. will be generated. The maximum power of the station will be obtained with a flow of 1800 second-feet when 73,800 hp. will be generated with an effective head of 418.2 feet.

The excitation at this station is normally furnished by an exciter direct connected to the main unit. As a spare there is installed a motor driven d.c. generator of 225-kw. capacity which has an extended shaft opposite the motor end, on which is mounted an impulse wheel for emergency operation.

Initially, the power will be transformed from the generator voltage of 11,000 to 110,000 volts for transmission to the San Francisco Bay district. When this time arrives and the transmission line is built to Substation No. 1, the transformers at Hat Creek will likewise be connected for operation at 110,000 volts and connection made to Pit River No. 1 line. The transformers at Pit River No. 1 are seven in number, each of 16,667-kva. capacity, connected in two banks of three each, one being a spare.

Eventually the voltage will be raised to 220,000; for this condition the 110,000-volt transformers at Hat Creek No. 2 will be removed and the power generated at 6600 volts will be stepped up by new transformers for transmission to Pit River No. 1. This transmission voltage is tentatively fixed at 11,000.

Study is being given to the switching equipment which will be of the out-door type. This will be for 220,000, 110,000 or 170,000 as may be determined by considerations of cost. Since the transmission lines receiving the output of this and the Hat Creek plants will be operated at 110,000 volts for some time, it may prove inadvisable to make the costly investment at the present time in 220,000-volt switching equipment, as the manufacturers predict advances in design with lowered costs. Furthermore, any 110,000-volt switching apparatus now used may be readily employed elsewhere in the system where this voltage is employed.

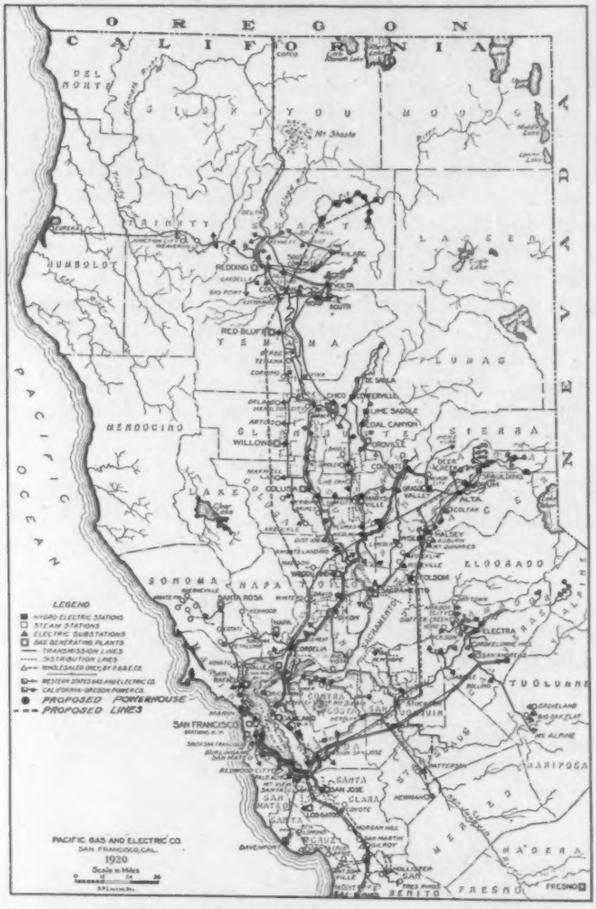
Transmission

Two transmission lines on separate structures will be built from Pit River No. 1 to Cottonwood, a distance by one line of 60 miles and by the other of 70 miles. From this point there will be two circuits on single towers 142 miles to a point tentatively fixed at about 5 miles northeast of Vacaville, where there will be installed synchronous condensers for line regulation, and transformers. This is referred

Looking down Hat Creek from Hat Creek No. 2 power house. The inflow from Crystal Lake enters Hat Creek between power houses No. 1 and No. 2, permitting a normal development of 8,630 kw. at the lower plant.

to as Substation No. 1. From this point it is contemplated to run a single circuit on double circuit towers to a position near Sunol or Newark, where a second substation identical in character with the other will be built.

For some time Pit River power will be brought into Oakland from Substation No. 1 by way of Cor-



Map of the Pacific Gas & Electric Company's system. The dotted line indicates the course of the 220,000-volt line now under construction and expected to be put into operation in 1924.

delia Substation and Carquinez Crossing over the bay lines reconstructed for 110-kw. operation.

The equipment for Substation No. 1 will consist of seven auto transformers, each 16,667-kva. capacity connected in two banks of three each, one bank for each Pit River circuit, one transformer being a spare. These transformers are for future operation at 220,000-110,000 volts, and have a tap for 160,000-volt operation. 11,000 volts from tertiary windings will be available for synchronous condenser operation. These condensers, with direct connected exciters, two in number, one for each line, will be of the horizontal type with revolving field, rated at 20,000 kva. at 1050 amperes, 11,000 volts, 600 r.p.m. When Pit River No. 1 plant is completed the operating voltage will be 110 kv. and the power transmitted about 90,000 kw., which will absorb the power from the three plants now under construction.

110-kv. operation will continue until Pit No. 3 plant is completed, when additional line capacity will be required. To meet this condition the line voltage will be raised to 220 kv. At this time the 110-kv. transformers at Hat Creek No. 2 will be removed and the power generator at 6600 volts will be stepped up, presumably to 11,000 volts by new transformers for transmission to Pit River No. 1, where it will be delivered to the 11,000-volt bus of this station and there together with Pit No. 1 power raised to 220 kv.

It is expected that the 220-kv. operation will be initiated in the year 1924, and the lines with respect to towers, conductors and insulation are being constructed now for operation at this voltage.

Possession by the company of Pit River and the starting of this project is due to the vision of Mr. Frank G. Baum, consulting hydroelectric engineer for the Pacific Gas and Electric Company, and the work is going on under his immediate supervision.

ELECTRIC HEATING OF TEXTILE MILLS

BY WIRT S. SCOTT
Mgr. Industrial Heating Section, Supply Dept., Westinghouse Electric & Manufacturing Company

An interesting advance made recently is the heating of a large textile mill electrically. It has been an accepted fundamental principle that electricity could not compete with coal for the heating of buildings. Recent investigations have been made, however, which show that electricity can compete with coal, taking all the facts into consideration, and when current is obtainable at one cent per kw-hr. and coal at eight dollars per ton.

The Canadian Cotton Mills of Canada entered into a contract with the Westinghouse Electric & Manufacturing Company for the heating of one of their new mills being built at Milltown, N. B. The building is 184 feet wide by 410 feet long, two stories high, and has an installed capacity of 2200 kw. for maintaining a temperature of 65° F. within the building, with an outside temperature of 20° below zero.

A hot air system of heating is employed, this being recognized as the most effective manner of heating a building, besides providing good ventilation at all times.

The heaters are concentrated into the two centralized systems, one for each half of the building, and are placed in the housing similar to those used with steam coils, the air being drawn through the heaters by a suction fan, and distributed through the building by means of vent pipes.

Electric contact-making thermostats are used for maintaining the temperature constant within narrow limits; these, in connection with magnetic contractors, automatically hold the temperature constant at 65° throughout the entire 24 hours, irrespective of the outside temperature. The installation is thoroughly safeguarded so that in the event of the power going off the motor driving the exhaust fans, the current is automatically cut off the heaters. It is further safeguarded to the extent that if the temperature within the heater housing goes beyond a predetermined limit, the heaters are automatically disconnected from the line. In the event that the temperature within the room should go beyond a given point due to the possible failure of the controlling thermostats, a separately operated thermostat will cause the sounding of a loud gong.

Why Steel Towers are Needed in Electrical Transmission

BY G. E. HONN

(Low cost is not always economy. The great steel towers which characterize the modern high tension transmission line, are superseding the old wood pole for definite economic reasons. The assistant manager of the steel tower division of the Pacific Coast Steel Company explains here how the efficiencies of higher voltage, and the industrial demand for uninterrupted service, have made the steel tower not only inevitable but economical.—The Editor.)

Progress in all branches of the electrical industry has been so rapid that most of us find ourselves lagging considerably behind. It is interesting to note what a difference a few years can make. The evolution of trunk transmission lines has been very noticeable, so much so that we find ourselves asking why the costly galvanized steel tower is taking the place of the inexpensive wooden pole.

	Type of Structure	Height	Av. Span	No. Per Mile	Voltage	WIRE Size	Wt. per ft.	Dia. Ins.	Area Ins.	Stress each	No. of Conductors	Overturning Load	Max. Sag	Distance between Conductors Vert.	Horiz.
NEW	Steel Tower	97 ft.	800 ft.	7	220 kv.	500,000	1.54	0.91	0.393	6300	6	37800	23	15	24
OLD	Wood Pole	45 ft.	250 ft.	21	60 kv.	3/0	0.629	0.41	0.1318	1900	3	5700	3	3	6

Comparison of Old and New Lines

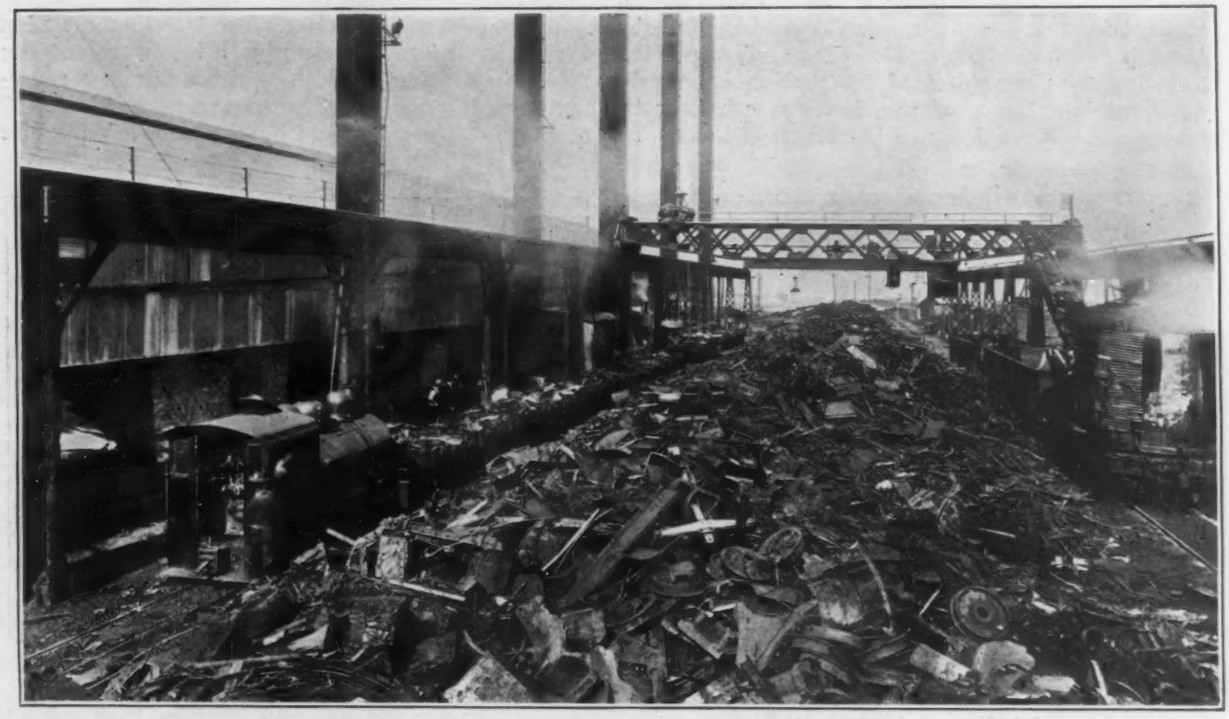
We will first make a comparison of the old line of fifteen or twenty years ago with our latest achievement. For brevity we have made a direct comparison by tabulation. The sags and stresses are only approximate, but are close to the maximum field condition.

Both the length of lines and the amount of current carried have been increased, making it more economical to transmit higher voltages. This has changed the type of insulator from pin to suspension, and necessitated greater distance between conductors which, in turn, has necessitated higher supporting structures and stronger and longer cross arms.

Insulators have always been a source of trouble, and to avoid this, longer spans were needed. The wood pole was already weak, a 45-ft. pole failing with a breast pull of 1600 pounds and very much less when an eccentric or torsional load was applied. The increase in height, and the longer arm, weakened it still more, and as a matter of safety it had to be abandoned in all high voltage and important lines. A glance at the above table will show that a wood pole, unless it is guyed, is unsafe for even a single 3/0 wire.

Reliability of Steel

It was therefore necessary to find a material adapted to structures of greater height and strength. Steel is such a material, but owing to its rapid oxidation is not practical without some rust-resisting coat. Galvanizing giving the best protection known for such purposes, and being comparatively inexpen-



Scrap heap at the works of the Pacific Coast Steel Company where the metal is procured for the steel towers which are to carry the 220,000 volts. Most anything can be found in this heap from spare parts for Fords to discarded baby buggies.

Seventy-five tons of molten steel are handled at one time by this ladle which is operated by an electric crane. The ingot moulds are seen at the right, ready to receive the pour.

After the ingots are poured they are stored with the number of the pour marked on the side. Each pour is analyzed and when a particular steel is needed the ingots are carried to the rolling mill by the magnetic crane.

sive when its durability is considered, was naturally chosen. The galvanized transmission tower, therefore, was a necessary change demanded by progress, and the wood pole was abandoned in important trunk lines because it was not adapted to the purpose. It still has its place in distribution, but even here it is doomed owing to the decreasing supply and increasing price. Latticed steel poles are now being used in many places for this purpose, being stronger and longer lived.

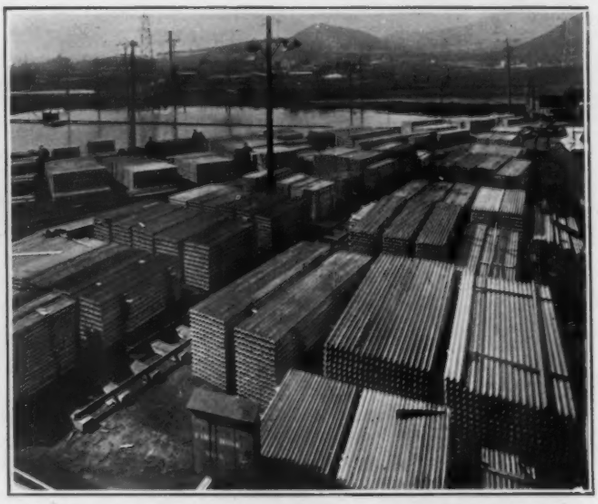
The steel tower is self-supporting, and can be designed to give the desired strength and ground clearance. Each line being a separate problem, a tower is designed to fit its special needs. The distance between conductors, the size of wire, and the length of span being decided, the problem is entirely mathematical, the maximum loadings can be estimated and a tower designed to withstand them. To make sure that the tower is as strong as theoretically figured, the general practice is to test each type of tower at the contractor's plant before the final drawings are accepted.

In the past winter eighteen breaks were caused by one storm in one of the Pacific Gas & Electric Company's 17-kw. lines, due to an observed snow load twelve inches in diameter on No. 5 stranded aluminum wire. A tower would have withstood this load. Fire has often destroyed miles of wood pole lines, and many times it has taken all the men available in a district to save a line from destruction.

Industrial Demand for Uninterrupted Service

The first cost of a tower line is little more than that of a wood pole line, for each tower replaces six poles, the spacing being three times as great, carrying twice the number of wires, and saving 33 1/3% of the insulators required by the latter. When life

Machine shop where the angle irons which compose the frame work of the towers are punched for the bolt holes and sheared off into the proper lengths for the various parts.



Galvanized tower parts waiting shipment. This is said to be the largest amount of galvanized steel ever held in one place and its value is placed at three-quarters of a million dollars.

and service are considered, steel is far more economical, for a tower line will outwear three pole lines and will give continuous and uninterrupted service. This fact alone is of the greatest importance. Today practically all our large industries are operated entirely by electricity; the small plant and even the farmer depend on it for their power. Contracts are drawn up in such a manner by the large consumers that the furnishing company is penalized hundreds of dollars per minute for all interruptions of over ten or twenty minutes' duration. From this we see that the loss involved in an interruption of only a few hours on one of the large trunk lines would amount to the cost of an entire galvanized steel transmission line. It is no wonder, then, that only structures which are absolutely safe are used for such purposes.

A more concrete idea of the loads towers are required to withstand can be gained from the accompanying sketch, which shows the details of the test loadings required by the Pacific Gas & Electric Company for their anchor tower to be used in connection with their 220-kw. Pit River transmission line.

Test No. 1 in the sketch represents a condition in which three wires are broken on one side of the tower, causing a pull of 10,200 lb. on the end of each of the three arms. The vertical loads of 1,400 lb. each represents the weight of the wires, and the transverse pull of 8,800 lb. is to take care of any load due to wind on the wires and the tower itself, together with an allowance for a slight angle in the line.

Test No. 2 represents a case in which all six wires are broken on one side of the tower, at once, leaving a load of 10,200 lb. applied at the end of each arm. The vertical load, as in test No. 1, represents the weight of the wire, and the transverse pull of 7,900 lb. is the wind load. This is the largest known test applied to a tower of this kind, giving a total breast pull of 61,200 lb., a total vertical load of 8,400 lb., and a transverse pull of 7,900 lb., or a total load of 77,500 lb., or 38.8 tons, beside the weight of the tower. These tests were applied to the tower shown in the figure.

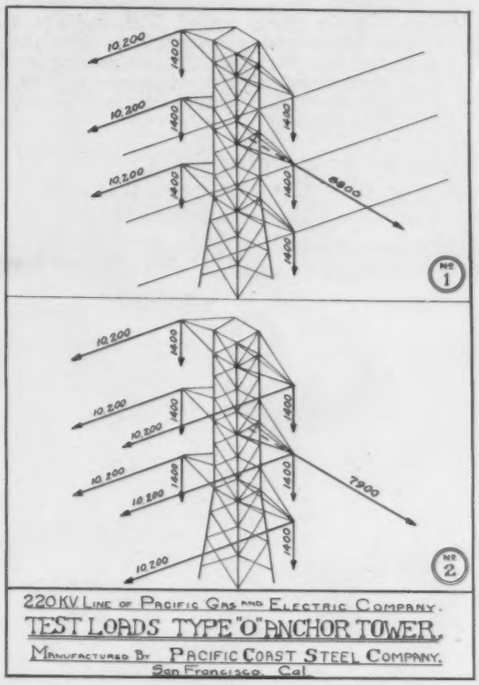
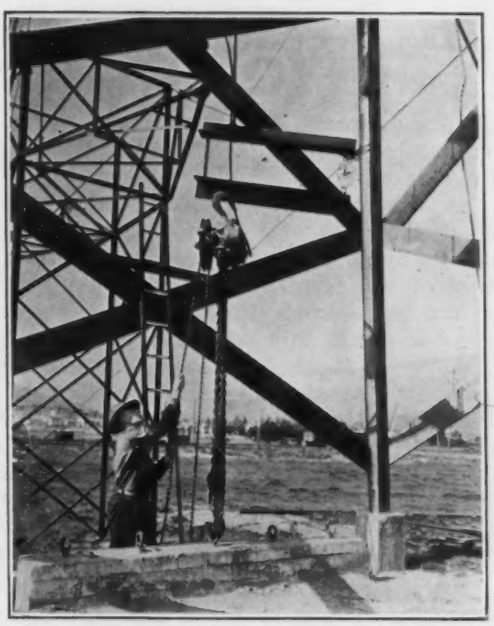


Diagram showing the tests applied to the type O towers of the Pacific Gas & Electric Company. The apparatus for making these tests is shown in the frontispiece of this issue.

It is interesting to note that the pioneering work in high voltage and long transmission has been done in the West. California is now taking the lead in the development of the 220-kw. line.

The Pacific Coast has also developed a steel industry capable of handling the manufacture of towers from the raw material to the finished product. These towers are made by the Pacific Coast Steel Company, which has developed a special alloy steel at its South San Francisco plant, having unusually high strength combined with extreme ductility.

When one realizes that the huge wooden testing frame shown in the illustration, 100 feet high and 40 feet long, guyed to a deadman buried 10 feet in the ground, was taxed almost to its capacity in applying the test loads to this steel tower, there is no room to wonder why the single wood pole cannot be used in the modern transmission line.



Testing the cross arm of one of the new towers by putting a pull of 1400 pounds upon the end of it. On account of the pull exerted on other parts of the tower the dynamometer is fixed at a ratio of six to one.

UNEMPLOYMENT NOT ACUTE IN WEST

Figures on unemployment indicate that the West is in a better condition in this respect than Eastern centers. Since these figures were given out, conditions are slightly improved. Figures given for February 1st are: 1,819,272 in 141 cities. New York, 300,000; Detroit, 150,000; Philadelphia, 235,000; Baltimore, 20,000; Chicago, 200,000; Cleveland, 118,000; St. Louis, 40,000; Boston, 50,000; Milwaukee, 40,000; San Francisco, 15,000; Seattle, 9,000; Pittsburgh, 20,000.

Why Is 220,000-Volt Transmission Necessary?

BY J. P. JOLLYMAN

(Is the piling up of high voltage transmission records anything but a wasteful rivalry between power companies? For the benefit of the large industrial users of power who are not familiar with the engineering problems involved, the economic basis and increased efficiencies of higher voltages are here explained in non-technical language by the chief of the Division of Hydroelectric and Transmission Engineering, Pacific Gas & Electric Company.—The Editor.)

The question has often been asked, "Why is it necessary to raise the voltage of transmission lines to such extreme voltages as 220,000? Are the power companies just a bunch of kids, each trying to outdo the other in making records, or is this done in the best interests, not only of the company, but also of the consumer?" The answer to those questions does not have to be given in formulæ involving calculus, nor in highly technical language. The fundamentals governing the transmission of electric energy are well understood by electrical engineers, and the higher voltages which are now being used and which are planned, are the most economical methods of transmitting the large blocks of power which are now being generated in one place, and moved to their place of utilization—the consuming community in the West being, in the majority of cases, far from the place of generation.

The right-of-way clearance for the 220,000-volt line at present being constructed by the Pacific Gas & Electric Company, which is to transmit power a distance of approximately two hundred miles.

If the cost of building a transmission line to carry electrical energy at 110,000 volts is $1,500 per mile, and it will carry 80,000 horsepower of energy, and it costs $3,000 per mile to build a transmission line to carry electrical energy at 220,000 volts which will carry 320,000 horsepower, which is the more economical? The fact that when the voltage of a line is doubled its carrying capacity is increased four times, shows that even though the cost of installing such a line is doubled the cost of transmitting the energy is only one-half. Another factor which enters into the building of higher voltage lines is the line loss, which is the energy lost in useless heating of the line wires. With a line 200 miles long, which is the proposed length of the new line from Pit River, this loss at 110,000 volts would be 16%, while at 220,000 volts the loss would only be one-half of that, or eight per cent.

The problem in transmission which confronted the engineers of the Pacific Gas & Electric Company in determining the most economical voltage for transmission from Pit River to the San Francisco Bay district was the following: The distance was approximately 200 miles; the amount of energy to be transmitted will ultimately be over 325,000 kilowatts or 440,000 horsepower. To determine the voltage which would be most economical, investigations were made based upon the following facts: As the length of the line is increased, a higher voltage is desirable, since the line loss is directly proportional to the length of the line and increases as the square of the load carried. That is, if the voltage is kept constant on a given line and the load doubled, you will have four times the line loss that you had in the first case. It would not do any good to increase the size of the wire beyond a certain point, as there is a point beyond which, with a given frequency, voltage and length of line, an increase in the size of the conductor will not increase the capacity of the line. It was found that at a voltage of 165,000, a single circuit would be able to carry 67,000 kilowatts and at 220,000 a single circuit would be able to carry 120,000 kilowatts, or 160,000 horsepower. Therefore it would be more economical to build two two-circuit lines to carry the 440,000 horsepower which would be generated at Pit River at 220,000 volts, than to build eight circuits for transmission at 165,000 volts, or sixteen circuits at 110,000 volts. The number of circuits in each case allows for some reserve capacity.

This was very well brought out by Mr. F. G. Baum, consulting hydroelectric engineer for the Pacific Gas & Electric Company, who is at the pres- insulators for this line. In a recent article in Electrical World he said, "Engineers would be making a mistake to go to these higher voltages just because mistake to go to these higher voltages just because they are higher. The economics of engineering development must play the heaviest part. This thought goes even farther. In the great hydroelectric development of the country that is coming, engineers must not be encouraged to build the highest dams, the largest plants, lines of the highest voltage, just because they are record-breaking. Conservatism and good economics must rule. Engineers ought to be honest and make honest estimates—not a million-dollar estimate where it is known the job ultimately will cost two millions. If the engineers do not act conservatively and honestly, there will once more be hydroelectric failures and loss of public confidence.

"In the Pit River development we are going to transmit energy at 220,000 volts, not because it is a record, but because it costs less. At the lower voltages the regulation was poorer and more circuits were needed."

Trouble Shooting in Gold and Silver Mining

BY B. B. BECKETT

(The practical problems which arise in connection with the electrical equipment on mines are of particular interest to the West where mining holds so important a place in industry. The following practical treatment of emergency repairs on electric drive in mines is by a well-known consulting engineer who was formerly electrical engineer for the Goldfield Consolidated Mines, Nevada. The methods apply equally well of course, to electric drive in any industry. —The Editor.)

The first paper under this heading appeared in the October 15, 1920, issue of the Journal of Electricity, and covered the subjects: frequency of failures; spare equipment and parts; causes of failures; inspection; and lubrication. The present paper will deal with emergency repairs. While the statements may be applied to electric drive equipment under any similar conditions, they are made with special reference to the gold and silver mining industry and particularly to the plant of the Goldfield Consolidated Mines Co. at Goldfield, Nev.

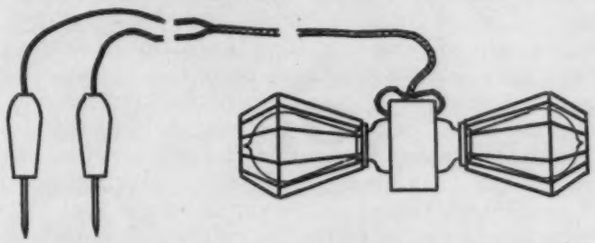


Fig. 1.—One form of test lamps for 440-volt work. Two 250-volt carbon filament lamps are mounted as shown and connected in series with about 12 ft. of reinforced cord and provided with steel point terminals. The points are of hard steel so that they will not become blunt when used for sticking through insulation against copper. The handles are of wood.

When called on trouble, the electrician will usually get the report of the operator who has called him and proceed immediately to examine the motor or other apparatus, observing particularly the temperature of all parts. Usually the report is to the effect that the motor would not start or was throwing fire or smoking, sometimes that it was running slow, or that the starter was smoking. If there is no superficial evidence of trouble, the electrician will attempt to start the motor with a view to locating the fault by observing the flash or smoke, if any; for the time saved by so doing will usually be worth the damage done. If experienced in such work, he will usually find the trouble at once and without the aid of any testing instruments, but some cases are very puzzling and simple instruments are helpful.

Instruments Used

The following instruments are in common use for such work, their relative importance being indicated by the order in which they are given.

(1) Test lamps.
(2) Magneto.
(3) Portable voltmeter.
(4) Portable ammeter with transformers.
(5) Wheatstone bridge test set.

The simplest test instrument and the one most often carried by the trouble man is the test lamp, or lamps. The accompanying sketch (Fig. 1) illustrates the common arrangement of lamps for 440-volt work. Note the steel point terminals. These are for getting contact by simply sticking through insulation without doing appreciable damage. Similar terminals should be provided with the magneto, portable voltmeter, or Wheatstone bridge. They will save time.

The split core type of transformer is the most convenient form for use with the portable ammeter. These are made only for heavy currents, 125 amperes or more, full scale reading, but small currents may be read with equal accuracy by simply looping the primary mire through the core twice or more.

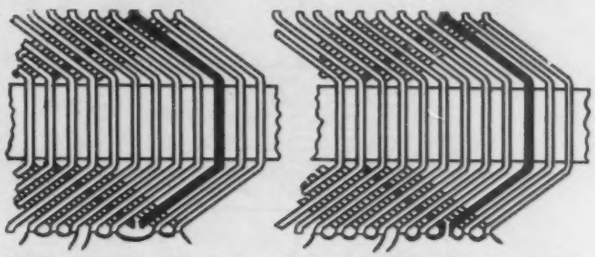


Fig. 2.—Two ways of cutting out a damaged coil; at the left, short circuited but ungrounded coil converted into single turn coil by opening all turns and soldering together all ends on each side; at the right, short circuited and also grounded coil isolated, jumpered, and opened through all turns.

Locating the Fault by Test

Such an ammeter is particularly useful in determining, without shutting down, whether or not a motor is running single phase or unbalanced. Usually this is sufficiently evident from the sound, or the speed and temperature, but these are not always conclusive. Sometimes the location is so noisy that the characteristic single phase hum is not evident, and low speed and high temperature may be due to overload caused by trouble in the driven machine. In case of a delta connected motor that has become open internally, either an ammeter or a Wheatstone bridge is very useful. Such a motor will start and run normally under light load but simply act as if overloaded when the load approaches normal. Neither the test lamps nor voltmeter nor magneto will show this fault, since the motor will test closed between any two terminals. The ammeter will show that the current on one lead is nearly double that on either of the others, and the bridge will show that the resistance between one pair of terminals is exactly double that between either of the other two. The bridge may also be used to locate the exact position of the break, as follows: Starting with one terminal of the bridge connected to one of the pair of motor terminals that showed the high resistance, move the other from coil to coil along the winding, following the phase known to be in fault, until a great difference of resistance is found between one reading and

the next. The fault will then be located between the points on the winding at which these two readings were taken.

In case of a star connected motor, a similar fault may be exactly located by the same method, but a magneto or voltmeter or the test lamps may be substituted for the bridge, since one motor terminal will then be isolated. In either case, such a fault may be quite puzzling to find, even after it has

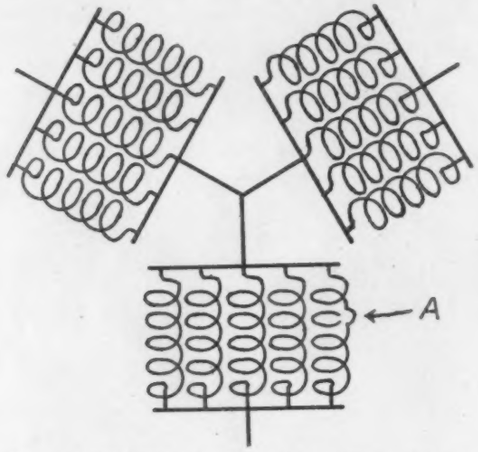


Fig. 3.—Diagram illustrating 5-multiple star winding, each loop of the diagram representing one coil. This will not do as the group will not balance with others in the same multiple. It will be necessary to remove the jumper, leaving the entire group open, or else cut one coil from each group of this phase.

been located in a particular coil or connector, because the break may be covered by insulation showing no burn, and may be covered by other parts of the winding so as to render it difficult to move the parts and observe the loose connection. On the other hand it is always well to make a thorough inspection first, since the fault can usually be seen and so found much more quickly than by the tedious method of testing. Sometimes the fault is inside a slot, being due to a ground that has burnt itself clear, leaving the coil open. In this case it will usually be evident as soon as the rotor is taken out. With small motors, the rotors of which can be handled by hand, this should be done at once without taking time to test; but with large motors, particularly where facilities are meager, it may require several hours for a crew of men to take out a rotor only to find that it was unnecessary as the fault was on the outside. In this case a careful search with a bridge or other testing device in advance would be justified.

Repairs with Minimum Shut Down

Knowing that the thing of first importance is to get going again, the first impulse of the electrician is to send the motor into the shop and put in another one, provided a spare is available. This is not always the quickest way. Often a motor can be made serviceable by simply cutting out one or more coils. In case only one coil is damaged, it should always be cut out in preference to sending the motor into the shop, and usually in preference to trying to patch the coil. If several coils are involved, however, particularly if they are in the same phase, it becomes a question for an expert. If he decides to cut out, he may find afterwards that the motor will not carry its load without dangerous temperature rise, or that other coils have been so damaged that they break down later. His attempt to run the motor in weakened condition may result in burning it out altogether. On the other hand, motors have run for years with several coils cut out, just as long, in fact, and just as satisfactorily, as if they were whole. Damaged coils can be cut out very quickly, thus entailing the minimum shut down.

Cutting Out Coils

In cutting out coils, the following points are to be noted. If the coil is grounded, it must be isolated and should then be completely opened by cutting through all turns at one end, for otherwise it is likely to become shorted, if not already so, and would then heat up from short circuit current generated within itself. If short but not grounded, it may still be used as one turn coil (see Fig. 2). If the coil is neither short nor grounded but simply open, this will usually be found at a terminal and can be readily repaired, but may be in the body of the coil. In that case it should be cut out, for even if it could be repaired successfully, the time required would not be justified, unless, indeed, there was reason to believe that the motor would not carry its load without that coil.

Conditions favorable to a motor running with coils out are:

(1) Low line voltage as compared with normal rated voltage, and, coupled with this, low normal flux density in the particular motor in question. Another way of stating the same thing is to say that, when running normally under light load, the motor core was quite cool; and if this fact has been observed beforehand, then this is favorable for cutting out coils.

(2) Light load to be carried as compared with what the motor is normally able to carry, as evidenced by the fact, observed beforehand, that the motor ran cool when under the heaviest duty required of it. This is better evidence than any local measurements.

(3) Equal distribution of the several coils, when several are damaged, among the phases. It does not follow and is not recommended that good coils should be cut out merely to secure balance. If, as is usually the case, the line voltage is unbalanced, care should be taken to connect the weakest motor phase to the lowest line phase.

(4) A star connected rather than a delta connected motor, unless the damaged coils are equally distributed. This is simply because coils in one phase of a star connected motor really affect the potential across two phases.

(5) A motor having a relatively large number of coils in series, since the percentage of total turns cut out is what counts.

In case of a series multiple winding, it is of course absolutely necessary that all groups in the same multiple have the same number of coils and that each coil have its full number of turns; for otherwise the unbalanced counter-electromotive force would result in heavy local currents circulating between the groups. (See Fig. 3.)

Rotor Trouble

When a motor acts as if overloaded and yet, by ammeter test, is not unbalanced nor taking excessive current, the trouble is usually in the rotor. Cage wound rotor troubles are of two kinds: (1) loose or broken bars, and (2) high resistance due to oxidation between bars and rings. This latter is a common occurrence with the old style bolted construction, and

it is to eliminate this trouble that modern motors are built with welded or solid cast cages. Usually this trouble is readily detected by feeling the rotor, which will be very hot, sometimes even red hot; but occasionally the oxidation has progressed so far that the rotor is almost open circuited. This means that the motor will start and run normally without load but will stall under very moderate loads and stand still without overheating. The remedy is to dismantle the entire cage, clean all contact surfaces bright, and re-assemble. It will be found, of course, that the insulation is of no use except to hold the bars snugly in place. We have successfully repaired a number of cages of this kind by welding the bars to the rings with acetylene or carbon arc without dismantling them.

The other kind of rotor trouble mentioned above. i. e., broken or loose bars, will be evidenced by firing at the break whenever the motor is started, and the fault can be readily distinguished from one in the stator by the fact that the fire goes round with the rotation of the rotor. This fault is not serious and, unless the motor is heavily loaded, it will run quite satisfactorily with several broken or loose bars. As it comes up to speed, the firing will stop, as the rotor voltage will then be too low to force any current across the gap. The motor will then run as if these bars had been cut out. There is one danger to be guarded against here. If too many bars are out in one place, the magnetic pull on this section will be much greater than that on the opposite side and the rotor may be pulled over against the stator.

Bearing Trouble

One of the first things to examine when called on motor trouble is the bearings. After feeling them for temperature, the next step is to see that the rotor turns freely by hand. This is not always conclusive as the belt pull under load or an unbalanced magnetic pull in the air gap may cause the rotor to strike although clear when tried by hand. The steel gauges may be used to ascertain the amount of clearance and if less than 10 mils, the bearings should be condemned or shifted, anyway. If the rotor does strike while in operation, this will usually be evidenced by firing in the air gap, due to mechanical heating. If this has occurred for any length of time, the coils will have been scorched, and even if there is no electrical fault as yet, failure is almost certain to follow within a few months. Air-drying insulating varnish may be used to advantage on such spots. Sometimes the top coils may be raised and reinsulated, particularly if they are of strap wound type.

A Puzzling Case

The following example from actual experience will illustrate some of the above points. A 100-hp. motor of modern design, having cast welded cage, had been running for several years continuously carrying about 80 hp., when it was reported throwing fire. The fire traveled round with the rotor but persisted after the motor was up to speed. The rotor turned freely by hand and was visibly clear all around. The firing was so considerable that it was decided to take the rotor out, although there was no other evidence of any fault and the stator had been found perfect when tested with the Wheatstone bridge. When the rotor was out, we were astonished to find that fully one-fourth of the rotor bars were broken off on one side so that the rotor was open for one-fourth of its circumference; also this side of the rotor was rubbed bright and the stator core was rubbed bright all the way round. The firing was due to mechanical friction and the heat had, of course, burned the stator insulation, but as the coils were mica insulated and quite dry, they showed no fault. The cause of the breaking of the bars was traced to vibration due to a badly spliced belt and an ill-fitting pulley. The breaking had progressed gradually, and as the motor was never shut down, it had given no sign until the unbalanced magnetic pull became so great as to cause rubbing in the air gap. This was only possible by flexure of the shaft. The broken bars were repaired by acetylene welding without dismantling the cage.

A STUDY OF PACIFIC COAST FOREIGN TRADE

Mr. Edward N. Hurley, who was chairman of the Shipping Board during the war and who is now visiting San Francisco, has made the following statement regarding Pacific Coast shipping:

The problem which the Pacific Coast faces is not a problem of putting a large number of ships into service between Pacific ports and the Orient, but it is the problem of extending our relations with Oriental peoples little by little, a ship at a time; and then, as our goods are absorbed and as markets are found for returned cargoes, other ships can be added and our commerce will grow on a sane foundation.

There must be cooperation between the five great ports of the Pacific. Seattle, Portland, San Francisco, Los Angeles and San Diego must all be equally interested in the success of their sister cities. They cannot progress on any other basis. The old-day bitter competition between cities has passed, and any other policy will tend to retard rather than to develop growth. Seattle must be interested in Portland's success; Los Angeles and San Francisco must work hand in hand, and traffic must develop along the lines of least resistance.

It is axiomatic that you cannot sell abroad what you do not produce, and the Pacific Coast will not benefit greatly simply as a transhipment point of eastern products. What is required here is the building up in the western states of a great workshop which will be for Pacific trade what the factories of New England and the North Central states are for our trade in the Atlantic; and into these western workshops, as into the workshops of New England, will flow the raw materials developed in the Mississippi Valley and the great inter-mountain territory.

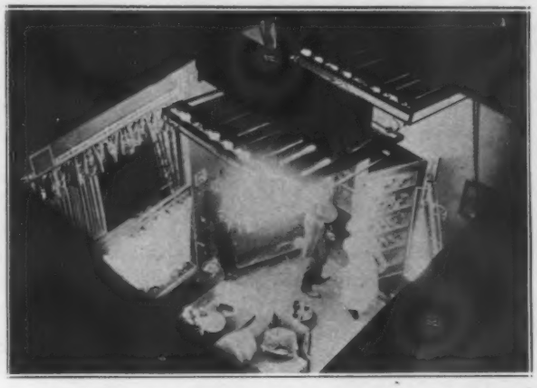
Comes, then, the problem of production and the forces which will turn the wheels for that production. Without coal, the Pacific Coast can turn to but two things for the development of its overseas trade — petroleum and hydroelectric power—and until these forces are fully developed and they in turn develop products for overseas business, the growth of trade in the Pacific will be retarded.

A $150,000,000 Industry in the West

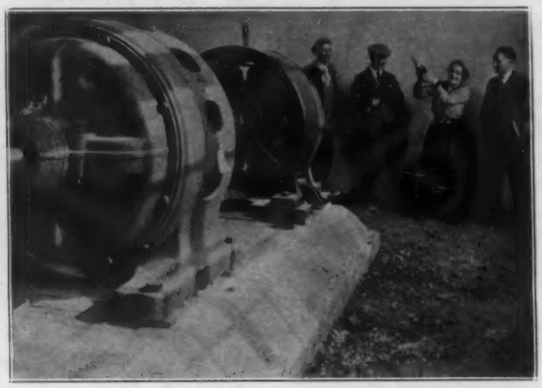
Filming an indoor scene in a motion picture studio. Over fifteen thousand persons are employed in the making of moving pictures in the West, the payroll and expenses amounting to over $30,000,000 annually. There are two hundred separate producing units in Los Angeles alone.

Before the perfection of electric illumination all pictures, even interior scenes, had to be taken out of doors. The result was that the realism was often marred by the draperies of the actors moving in the wind, or by sharp shadows obviously caused by bright sunlight. Electricity has changed this.

The value of new studios and studio buildings constructed in the West exceeded three-quarters of a million dollars during 1920. The picture above shows the electric flood-lighting of the Thomas Ince Studio, Los Angeles, built about two years ago, and having a very extensive electrical installation. The new studios are distinctive features of the landscape in and around Los Angeles.



A motion picture setting viewed from above. The proper spread of light is given by banks of mercury vapor lamps, and high lights are secured by the use of arc lamps. These different types of lighting, known as "hard" and "soft," play a very important part in making successful films.



One thousand horsepower is the average electrical installation for a modern motion picture studio, a condition which makes this industry an extremely important user of electric power. The picture above shows a new motor-generator set in the Brunton Studios, Los Angeles, being christened by Bessie Barriscale.

Over 300,000,000 feet of film is used by Los Angeles studios annually. Above are shown finished films stacked in the office adjoining the Famous Players Lasky Corporation's laboratory.

Film valued at more than $10,000,000 was exported from this country during 1919. The above picture shows one of the developing processes in film-production, photographed in the laboratories of the Famous Players Lasky Corporation, Los Angeles. Electricity plays a large part in the handling of the film, especially in the drying, which must be done with great care to prevent curling. The film is revolved on reels which are operated by an electric motor. The atmosphere in the drying room is maintained at a fixed humidity by automatic air-conditioning apparatus which washes, humidifies and circulates the air, and prevents the film from drying too rapidly. The printing in this plant is performed by an electrically operated printing machine which passes the film at a uniform speed across an aperture where it is exposed to the light from a standard 40-watt frosted globe tungsten lamp. The printing is so controlled that a uniform density is secured throughout the picture, regardless of variations on the negative.

Seventy-five per cent of the world's motion pictures are made in Los Angeles, and there are fifty-two studios in this city alone. The motion picture industry is now about the third largest in the United States. Above are shown the Goldwyn Studios, erected at a cost of over $1,000,000 and having every modern electrical convenience. There are two hundred dressing rooms, besides a complete barber shop, laundry, telegraph office, restaurant, soda fountain and infirmary.

REQUISITION FOR MATERIAL

NO ____ DATE 12-26-20
CHARGE TO JOB NO. 1 FROM STOCK? ✓ FROM VENDOR? ____
ROUGHING ____ FINISHING ____ TOOLS ____
NAME John B Stedman
ADDRESS 2635 Sixth St Bkly

QUANTITY	DATE DELIVERED	MATERIAL		COST
1	12-26-20	200 A D 3W Sw & Plates		6 3 90
6		2" Locknuts	C .22	1 32
2		2" Bush	C .34	68
2		2" LB Cond	C 3.34	6 68
2		2" Bk Cor	C .73	1 46
2		1½" Locknuts	C .12½	25
1		1½" Bushings		20
2		1½" 7" Nipple	C .50	1 00

REMARKS
TOTAL REC'D BY J.J.B 55 49

Form No. 1, the Requisition for Material. Size, 5 x 7. The total is circled after it is listed on the face of the job envelope, and just before this form is placed within it.

RETURNED MATERIAL RECORD

NO ____ DATE 12-29 20
CREDIT TO JOB NO. ____
ROUGHING ____ FINISHING ____ TOOLS ____
NAME John B Stedman
ADDRESS 2635 Sixth St Bkly

QUANTITY	MATERIAL		COST
2	2" Locknuts	@ .22	44
1	2" LB Cond		3 34
1	2" Bk Cor		73
1	1½ x 7 Nipple		50

REMARKS
TOTAL REC'D BY J J B 5 01

Form No. 3, the Returned Material Record. Size, 5 x 7. The total on this form is circled to indicate that it has been listed on the job envelope. It is now ready to insert in the envelope.

A University Course in Practical Cost Accounting

BY PAUL B. KELLY

(Are you operating your business at a loss? You cannot be sure that you are making a profit unless you keep track of all expenses, and know exactly how much each job costs you. Lesson One of this course, which is being conducted in connection with the Extension Division of the University of California, takes up the method of keeping job costs under the Standard Accounting System. The articles are compiled by Paul B. Kelly, research accountant, under the supervision of Henry R. Hatfield, Dean of the Faculties and Professor of Accounting of the University of California.—The Editor.)

GATHERING THE DATA: KEEPING JOB COSTS

In keeping job costs, the contractor-dealer undertakes to find the cost to each job of Material, Labor, and Direct Job Expense. To find what each job costs in these three respects is a very simple task. It is only a problem of establishing a routine which will take extremely little time and not be a hindrance, and which will be accurate and dependable. To find the total direct cost of a job, the contractor-dealer must record the material taken out on the job, the material unused which is returned from the job, the amount of time his men are engaged on the job, and all expenses incurred directly for that job such as carfare, expressage, and inspection.

In order to secure the record of these items quickly and accurately, special forms are necessary. The necessary forms have been devised and are a part of the Standard Accounting System. They can be purchased cheaply from the National Association of Electrical Contractors and Dealers. The forms used in keeping job costs are four in number:—

(1) Form 1. Requisition for Material.
(2) Form 3. Returned Material Record.
(3) Form 2. Time Card.
(4) Form 4. Job Envelope.

The first thing that the contractor-dealer should do after he secures a job is to start a Job Envelope. Each job is numbered consecutively. The Job Envelope is a stout manila envelope which keeps in one place all the material, labor, and direct expense data necessary to arrive at the direct cost of the job. On the outside of the job envelope spaces are provided for the job number, amount of the contract, name and address, and the date. These spaces on the job envelope should be filled out immediately. The job envelope should then be filed alphabetically with other "uncompleted" job envelopes. The other spaces on the job envelope are not to be filled out until later. Study Form No. 4.

Form No. 1. Requisition for Material

The first element of cost is material. When material is taken out of stock for the job, naturally the first form to be made out is Form No. 1, the Requisition for Material. On this form must be listed absolutely all material that goes out on the job—not merely the amount which it is anticipated will be used. The requisitions for material should be turned in to the office and costed daily. They are then filed in the job envelopes.

It is necessary to make out this form, whether the material is taken from stock or is ordered from the jobbing house direct to the job. The form provides for this notation. If the contractor-dealer maintains a perpetual stock record, requisitions for material should be made out in duplicate so that one copy may be used for this purpose while the original is filed in the job envelope. If a stock record is not kept by the dealer it will be unnecessary to make more than one copy of this form. Study Form No. 1 and the way in which it is filled out. It is self-explanatory.

Form 3. Returned Material Record

The amount of material which will be used for a job can not be exactly known beforehand. Therefore, in order to avoid a shortage, more material is usually taken out on a job than is actually used. Such material should be returned directly to the shop when the work is completed. The workman, or whoever checks the returning material, should fill out Form 3—Returned Material Record. He can fill out

all of the form except the cost column. These forms should be turned in to the office daily to be costed and filed in the job envelopes.

The best procedure is to have unused material returned directly to the shop. But if, for a good reason, material which has been charged to one job is later transferred to another, it should be charged to the new job on Form 1 and credited to the old job on Form 3. It is essential that care be exercised in this respect, for this is a point that may be easily overlooked. Study the manner in which Form 3—the Returned Material Record—is filled out in the illustration. A careful scrutiny should make its use thoroughly understood.

Form 2. Time Card

Labor costs and costs of carfare and telephone are recorded by means of Form 2—the Time Card. The time card is made out by the workman, either for the day or for the week, according to the practice of the shop. The use of a daily time card insures a more accurate record, but in localities in which the workmen do not come into the shop every day it may not be practicable and a weekly time card must be used. On the time card the workman lists the jobs on which he has worked and the time spent on each. If daily time cards are used they should be filed under the workman's name so that all of his cards are already assembled when his pay is computed at the end of the week. If a weekly time card is used, the workman is paid on the basis of this card and it is then filed under his name.

Before the time card is filed under the workman's name, however, a separate time card should be made out in the office for each job listed on the workman's card. These cards are then filed in their respective job envelopes. The charges for telephone and carfare should also be transferred to the time cards which are filed in the job envelopes. Study

FORM NO. 3

TIME CARD

J. B. Stedman — DATE 12 - 31 - 20

I WORKED TO-DAY AS FOLLOWS:	JOB NO.	CAR FARE	TELEPHONE	RATE	HOURS
Dec 26	1	12		1.35	8
✓ 27	1	12		✓	8
✓ 28	1	12		✓	6
Total		(36)			(22)

SIGNED J J Barnes

Sample of a weekly time card made out by the workman. It is not furnished by the Association. The items are circled to indicate that they have been transferred to job time cards. Size 4 x 7. After all items have been circled, this card is filed under the workman's name.

the weekly time card and the job time cards given in the illustration.

Form No. 4. The Job Envelope

The job envelope serves two purposes: 1. It acts as a convenient container for all the cost data on a job, for all the forms which are used for this purpose are filed in the job envelope. 2. The ruled form on the front of the job envelope serves as a working sheet for summarizing and arranging this data.

As the job progresses all the data is entered on the job envelope. Look at the job envelope in the illustration and see how the requisition for material and the returned material record have been listed. Note that the returned material record is entered in red ink. Red ink indicates that the figures written in red ink are to be subtracted instead of added to the other items in a column. If requisitions for material are made out in duplicate and are numbered, the requisition number should be entered in the proper column for this purpose on the job envelope. Usually requisitions for material will not need to be num-

FORM NO. 4

JOB ENVELOPE

JOB NO. 1 — DATE 12 - 25 - 20
AMOUNT OF CONTRACT T & M — CUSTOMER'S ORDER NO. ✓
NAME J.B. Stedman — Mdse 50.48 / Labor 40.00 / D.J. Ex 1.35
ADDRESS 2635 Sixth St Bkly
DATE BILLED 12 - 31 - 20 — TOTAL COST 91.83

MATERIAL			LABOR			DIRECT JOB EXPENSE		
REQ. NO.	AMOUNT	TOTAL	DATE 1920	AMOUNT	TOTAL	DATE 1920	AMOUNT	TOTAL
12 - 26 - 20	Mdse Taken Out	55 49	Dec. 26-28	Barnes 22 hrs	27 50	12-26-28	Barnes carfare	36
			✓ 26+27	Hart 10 hrs	12 50	12-26+27	Hart "	24
12 - 28 - 20	Mdse Retd	5 01				12 28	Inspection	75
TOTAL			TOTAL			TOTAL		

Form No. 4, the Job Envelope. Size, 8¾ x 11¼. The returned material record is entered in red ink, indicating that these figures are to be subtracted instead of added to the other items in the column. To the total direct cost of the job must be added a percentage for overhead and a percentage for profit, when billing the customer.

bered, and the date may be entered instead, as has been done in the job envelope illustrated.

Refer to the job envelope and note how the job time cards for each man have been listed under the column headed "Labor." The information which is listed there facilitates billing for the job, and is available for quick reference.

The column of the job envelope headed "Direct Job Expense" is for the entry of such items as "Telephone" and "Carfare" which are entered here from the time cards. Freight, express and carting directly applying on a particular job would be entered in this column, also, from the receipted bills. The charges of the Electrical Department of the city for inspection and permits should be entered in this column together with any other expense directly incurred for a particular job.

Time Card J. G. Barnes — ACME ELECTRIC CO. Date 12-27 To 12-31-20

	JOB NO.		HRS.	C F
SATURDAY				
MONDAY	1	J. B. Stedman	(8)	12
TUESDAY	1	J. B. Stedman	(8)	12
WEDNESDAY	1	J. B. Stedman	(6)	12
	6	H. L. Price	2	
THURSDAY	7	T. M. Knox	3	
	10	C. D. Evans	5	12
FRIDAY	10	C. D. Evans	8	12
		Time 50.00 C.F. 60 Total 50.60		

Received Payment J. G. Barnes 50.60

Form No. 2, the Time Card. Size, 3¾ x 6½. This form is also used as a daily time card if the workman makes out his time each day. The circled items have been listed on the job envelope. The card is ready for insertion in the envelope.

After all the data on the completed job has been listed, each of the three columns is totaled. The sum of the Material Total, Labor Total, and Expense Total gives the direct cost of the job. These three totals should be listed and added in the upper right-hand portion of the envelope as has been done in the illustration.

We have now arrived at the total direct cost of the job. To this figure must be added a percentage for overhead, and a percentage for profit, when billing the customer. The information as to the cost of material, labor, and direct job expense should be transferred to the duplicate of the customer's bill, as will be explained in the next lesson. After this is done the job envelope should be removed from the "Uncompleted" file and put in the "Completed Job Envelope File." Job envelopes in the "Uncompleted" file are arranged alphabetically according to the name of the customer; job envelopes in the "Completed Job Envelope" file are arranged according to the job number.

This system of recording costs may be installed at once. It is beneficial and useful regardless of when the installation of the rest of the Standard Accounting System follows. No trouble will be experienced with it. No inventories are necessary. All that is necessary is to give each job in progress a number, and to list the material and labor already expended on the job. The envelopes from thenceforth are maintained currently.

CONFIDENCE IN UTILITIES ESSENTIAL

E. I. Lewis, chairman of the Public Service Commission of Indiana, describes the public utility problem as follows:

"Two of the most vital needs of the country, at this time, are—first, confidence in public utility securities; second, substantial foundation for investors' confidence. Public utilities have undergone a strenuous four-year period, and they emerge from the distressing war era, the more strenuous post-war period and four years of increasing operating costs, in a condition that demands the closest and most careful attention.

"The result of these conditions over which the utilities and the regulatory commissions could not exercise sufficient control, for they were world-wide influences, is that the utilities stand today in a more or less depleted condition. Services may seem to be adequate and satisfactory, but there is a vast amount of substantial work to be done to give assurance to continuous and reliable operation.

"This demands in this country hundreds of millions of dollars in the next year or two. To obtain this money at reasonable rates, public utilities must have credit which will attract the investor's discernment.

"It cannot be emphasized too strongly that the establishment of such credit is really of more vital concern to the communities served than to the utilities serving them. Cities cannot grow without vast expenditures in the extension of water and gas mains, street car and telephone lines and other public services which are the very foundation of modern municipal life.

"Having adopted such a state policy, it is incumbent on the state now to provide sound foundations of security for the money that such public service demands. This calls for reorganizations of utilities where they are made anaemic and their services unreliable and weak by excess demands of securities that represent no substantial claim upon the public. Having established sound foundations, it is bad judgment for the state to call upon those who have placed their money in public services to accept less than a fair earning on such money.

"The sum total of state regulation of these utilities is the creation of a fair deal, and there can be no fair deal unless all parties at interest are included, and further than that, there can be no service rendered to the patron unless somebody—commonly known as the investor—provides the money necessary for the facilities of service.

"It is clearly the duty of the state to create conditions for investment that will make the investment just as good as government bonds. When that time is reached—and it is being reached in several states, that have not only regulation of rates, but also of securities and franchises—then the public may call on money, saying, 'Come to our service, in it you will be absolutely safe and we will pay you a fair, but not exorbitant, wage.'"

Interior of the J. C. English store. Note the absence of show cases, and the appliances displayed in wall cases accessible to the customer

An effective room for displaying fixtures. The greater part of the stock is kept in the cabinets against the wall, eliminating any "shop" effect

A Store That the Customer Remembers

(Every store should have a personality, and while for some time it was thought that the electrical store did not lend itself to distinctive treatment, the modern contractor-dealer is proving in such establishments as that described below, that beauty and "atmosphere" can be attained here as everywhere.—The Editor.)

THERE is no end to the things that may be done to an electrical store. The customers of the J. C. English Company of Portland, Ore., step from the crowded street into a spacious room faintly suggestive of an old Tudor mansion, a suggestion which is intensified by the hall and stairway at the rear of the store, worked out to look exactly like the hall and stairway of a residence. This device has two objects, besides the creation of the Tudor atmosphere. It gives an interesting and unique appearance to the rear of the store, immediately attracting the attention of the entering customer, and it serves to separate the less expensive display room from the place where the better fixtures are segregated.

The two fixture display rooms are designed to provide a simple and dignified setting for the fixtures, rather than to attract undue attention to themselves by elaborate color schemes or furnishings. The background is a neutral effect which shows off all the fixtures to the best advantage, whether they be iron, gold, or polychrome.

A multiplicity of displayed brackets on the wall is one of the features that has been eliminated in this store. The brackets are kept mounted on boards in inexpensive built-in fir cabinets, the cabinets being wired with a twin receptacle. When the bracket is to be displayed for the customer's inspection, it is removed from the cabinet, plugged into the receptacle, and hung on the wall. Thus it is separated from the rest of the stock, and the customer can see it as it will look in his own home, neither enhanced nor marred by the proximity of brackets of different designs and colors. Incidentally, it is said that customers show a much keener interest in finding out what is concealed in the cabinets than in looking at what is displayed on the walls.

A feature of the main store is the absence of show cases. The goods are displayed in wall cases which the customer can walk up to and inspect without finding a counter and a salesman between himself and the object of interest. The only counter in the store is towards the rear. It is twelve feet long and serves to conceal the lamp display case.

This hall and stairway immediately attract the customer's attention to the rear of the store, and supply the home touch.

The lower portions of the wall cases have cupboards in which is kept the stock of the merchandise displayed above. The upper portions of the cases have concealed glass doors on the sides so that the appliances are constantly under glass and do not require perpetual cleaning.

The walls of the store are papered with Kanestone, which gives an unusual and very striking effect, consistent with the residential note struck by the hall and stairway. The entire establishment leaves a very distinct impression in the customer's mind, and one not apt to be forgotten.

Are You Spreading the Electrical Idea?

BY J. D. DILLINGHAM

(One man with convictions can make more converts to the electrical idea than a host of indifferent men who "leave it to the industry as a whole." The building equipment specialist for the General Electric Company here recounts some interesting actual incidents which show the far-reaching effects of individual effort.—The Editor.)

A contractor made the flat statement that he believed there were more convenience outlets than was justified in some of the electrical homes recently offered for sale by progressive real estate firms.

"Why, not half of the outlets were in use in any one of the electrical homes that I visited, he complained to a group of friends, "and I'm telling you fellows that you can't get by with such unnecessary expense with either the architect or prospective home builder."

Another of the party, a man who sold supplies to architects, grinned. "Neither were all the water faucets in use when you saw them. Let me tell you of an incident which happened in the office of a friend of mine, who is an architect. I was in his office one day when an electrical contractor came in to submit a bid for the electrical installation of a seven-room home.

Informing the Homebuilder

" 'You don't seem to have plenty of convenience receptacles in this job,' he said, 'and if you don't mind, I'd like to make a few suggestions.'

" 'But,' said the architect, 'the owner simply won't stand for them. I mentioned them to him and he didn't think they were necessary.'

"Almost before the words were spoken, the client for whom the house was being planned entered the office. He and the architect seemed to be on good terms, and after the usual preliminaries the architect repeated the electrical contractor's complaint and introduced the two men.

" 'As a matter of fact,' said the client, 'I haven't given the electrical installation much thought, but I'd like to hear any suggestion you might have to make along this line.'

"With scarcely any discussion he agreed to the addition of seven receptacles, and after some discussion he agreed to the addition of six more, making a total of eighteen convenience receptacles where only five had been originally planned.

Educating the Architect

"Here's another incident: A short time ago another architect and I were discussing building in a general way. 'I always aim,' he said, 'to provide a sufficient number of these outlets, as you will see.' He went over the plans in a casual way, pointing out to me the various receptacles.

"I called his attention to the living room, in which he had shown two receptacles. 'Suppose,' I asked, 'your client wanted to put a floor lamp in either of these corners.'

"The architect looked thoughtful. 'Well,' he said, 'it might be rather awkward in such a case.'

"I referred to the back porch. 'Why not a receptacle in the wall here for ironing on a hot day, or maybe for a refrigerator?'

" 'Never entered my head, to tell the truth,' said the architect, and thoughtfully tapped the table with his pencil. 'These electrical homes that you were speaking about—do you know if any are on display at the present time?'

"When I saw him again, he told me that he had changed his ideas as to what constituted a sufficient number of receptacles in a home, and had added eight receptacles to the job we had discussed."

Significance of the Convenience Outlet

If you lack enthusiasm, consider for a moment the possibilities for increased business through the medium of the convenience outlet.

It is estimated by the United States Bureau of Housing that there is a shortage of three million homes in the United States. Suppose that two million of these houses are wired for electricity. The minimum number of convenience outlets in the average home should certainly not be less than ten, and more probably it should be not less than twenty. Assuming, however, the smaller number, we would have a total of twenty million convenience outlets. Figuring the contract price at the present price of about $5.00 per outlet, we would have a total business for electrical contractors in the United States of one hundred million dollars. If the larger average, or twenty receptacles to the home, was used in this estimate, the total would of course be $200,000,000.

And this is for the convenience receptacle alone. The convenient location of these outlets would unquestionably lead to such an increase in the use of electrical appliances, that the amount in dollars is almost inestimable. And considering that every household appliance when put into service immediately starts to create a demand for several more of its kind, it is indeed worth while to make every effort that will in any way tend to make their use more convenient.

Responsibility of the Individual

In other words, when you increase the number of convenience receptacles to the point where they are really conveniently located, you not only increase the wiring contract, but you are indirectly influencing the occupant of the home toward using more labor-saving electrical devices, as well as table or floor lamps, both decorative and simply practical. Then, to continue the chain, the devices used by this occupant influence his friends to purchase similar devices, and so on.

And all that is required to bring in this great volume of business, is a concerted effort on the part of the electrical fraternity. But remember that this concerted effort requires that each individual do his share.

A New Method for Proportioning Chimney Heights

BY ROBERT SIBLEY AND C. H. DELANY

(A new means—quick and accurate—for ascertaining the diameter and height of chimneys used for burning crude petroleum, coal, wood or any other type of fuel in industrial power plants is herewith set forth. In this article the authors first show the fundamental variables upon which the chimney proportions must depend both for fuel oil as well as for other types of power plants, and having established these fundamentals give a quick and ready means for determining these constants. The authors of this article are also joint authors of the well-known text book, "Elements of Fuel Oil and Steam Engineering."—The Editor.)

In the table herewith the available draft is given for chimneys of various diameters all 100 ft. high, with given quantities of flue gas passing per hour based on a temperature of gases of 500° F. For any other height of chimney the draft may be obtained directly from the table by simply multiplying the draft given in the table by the actual height, and dividing by 100. The set of curves in the diagram gives the same information, with the addition of extra scales which enable the draft to be determined for temperatures of 300° F. and 700° F., as well as 500° F. By interpolating between the results so obtained, the draft may be quickly determined for any temperature between these limits.

This table and diagram may be used for determining the height and diameter of chimney required for any boiler plant, to produce a given amount of draft, regardless of the kind of fuel used, provided the quantity of flue gas passing per hour can be approximately estimated.

The weight of flue gas passing per second or per hour depends, for practical purposes, on just two things:

(1) The weight of fuel burned.

(2) The per cent excess air used in burning it.

Other influences, such as moisture or oxygen in the fuel, or steam used to atomize oil, may be neglected, as their effect is small.

The weight of oil burned under a boiler, operating at 70 per cent efficiency, amounts to 2 2/3 lbs. per hour per blr. hp. As this efficiency is easily obtained with ordinary care, this is a liberal figure to use for design purposes.

Oil can be burned with no more than 15 per cent excess air, corresponding to 14 per cent CO_2, but as extreme care is required to attain this result the chimney should be designed on a more liberal basis. A safe figure to use is 50 per cent excess air, corresponding to 10 per cent CO_2. The theoretical amount of air required runs from 13 to 14 lb. per pound of oil, depending on the chemical constituents of air, and adding 50 per cent excess, we have a total of 21 lb. of air for each pound of oil, and as the pound of oil is completely gasified, there are 22 lbs. of flue gas per pound of oil. Multiplying this by the 2 2/3 lbs. of oil per hp. gives 58.7 or approximately 60 lbs. of flue gas per hour per boiler hp. Consequently the weight of flue gas per hour passing up a chimney may be estimated by multiplying the actual boiler horsepower by 60.

In practice it is customary to overload boilers up to 150 per cent, 200 per cent, and sometimes as high as 300 per cent of their rated capacity. The actual horsepower may, therefore, be very different from the installed capacity. In designing the chimney it is essential to know what capacity is expected from the boilers, and be guided accordingly.

An Example of Chimney Design for Sea-Level Installation.—Let us from this data ascertain the diameter of a 100-ft. chimney capable of properly creating a draft for a 1000-hp. boiler installation so that the stack is of sufficient size to accommodate a 50 per cent overload. It is assumed that the stack is centrally located and that it has short flue connections with ordinary operating boiler efficiency and that a draft of 0.5 in. at the base of the chimney is sufficient. Since the 1000-hp. boilers are to operate at 50 per cent overload, the actual horsepower will be 1500. Multiplying this by 60 gives 90,000 lbs. of flue gas per hour. From the diagram it is seen at

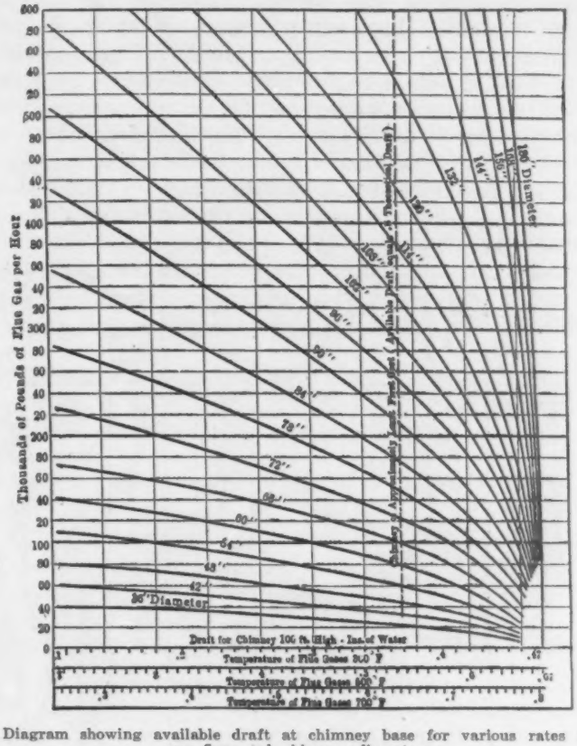

Thousands of Pounds of Flue Gas per Hour
Capacity of Approximately Same Flue Gases (Available Draft in Thousandths of an Inch)
180" Diameter
36" Diameter
Draft for Chimney 100 ft. High - Ins. of Water
Temperature of Flue Gases 300° F
Temperature of Flue Gases 500° F
Temperature of Flue Gases 700° F

Diagram showing available draft at chimney base for various rates of gas flow and chimney diameters

a glance that the chimney must be a little more than 60 inches in diameter to give the required draft of 0.5 in. with gases at an average temperature of 500° F.

It will be noted from the table that it is possible to get several different combinations of heights and diameters of stacks, to produce a given draft for

any particular weight of flue gas considered. For instance, the diagram shows that a stack 54 in. in diameter and 100 ft. high will give a draft of .36 in. when passing 90,000 lbs. of flue gas per hour at a temperature of 500° F. If the height of this stack is increased to 140 ft., the draft obtained would be $.36 \times 140/100 = 0.50$ in., which is the same draft for which the 60 in. × 100 ft. stack was figured in the previous example. A number of other combinations of height and diameter can be made that will give the same draft. The choice of the actual chimney to be used must therefore depend on other considerations besides the draft and in practice this point is settled by selecting the chimney that will be the cheapest to build. The cost of a chimney is roughly proportioned to its height times its diameter, and on this basis it has been found that the most economical chimney to build, for a given set of conditions, is that in which the available draft is equal to eight-tenths of the theoretical draft. In the diagram this relationship is indicated by the vertical dotted line, and the proper diameter of stack is found at a glance by noting the point at which the diameter curves cross this line. For example, considering once more the case of 1000-hp. oil-fired boilers operating at 50 per cent overload, and requiring .5 in. draft at the base, we have, as before, 90,000 lbs. of flue gas per hour at a temperature of 500° F. Following the horizontal line corresponding to 90,000 lb. per hour, until it crosses the vertical dotted line, we find that the cheapest chimney to build for this capacity will be between 60 in. and 66 in. diameter. It is customary to build stacks with diameters equal to some multiple of 6 in. We may therefore select 66 in. as the required diameter. The diagram shows that under the assumed conditions the draft for a 66-in. stack, 100 ft. high, will be 0.555 in. Since the draft required is only 0.5 in., the height of the stack may be reduced in proportion, making it 90 ft. high instead of 100 ft. It is thus found that the proper size of chimney for the conditions of the problem is 66 in. diameter and 90 ft. high.

Chimneys that have small diameters in proportion to their height are somewhat objectionable on account of the variability of the draft. At the full load of 1000 boiler hp., as we have seen, a 54 in. × 140 ft. stack gives the same draft as a 66 in. × 90 ft. stack. At light loads, however, the 54 in. × 140 ft. stack will give a much greater draft, for it still has its full height, but the friction loss is much less. This increase of draft at light loads requires special care on the part of the boiler fireman to adjust his dampers for proper air regulation.

Rule for Altitude Correction. — All chimney dimensions and tables have here been computed on the basis of sea-level pressures. A full discussion of corrections for altitude above sea-level was treated by the authors in the Journal of Electricity, March 1, 1920, page 222. Hence to properly proportion a chimney for a given altitude above sea-level, first pick the height and diameter for the boiler capacity on the assumption that the installation is to be made at sea-level. Next determine the height for the altitude desired by making the ratio of the new height to the sea-level determination inversely proportional to the barometric readings. The stack diameter is then increased so that the stack at the higher altitude should have the same frictional resistance as that used at sea-level. This new diameter is determined by multiplying the diameter obtained on the basis of sea-level assumption by the ratio r of barometric heights raised to the 2/5th power.

An Example of Chimney Design at Altitude.— It is now seen that the factor or ratio of sea-level pressure to the pressure at altitude enters as a first and a two-fifths power. By means of a chart published on page 222 of the Journal of Electricity, March 1, 1920, this factor may be quickly raised to the power desired for altitudes up to 10,000 ft., without any reference to barometric pressures.

As an example, let us find the proper proportions of a chimney to amply provide for a 1000 boiler horsepower installation situated 8000 ft. above sea-level.

We have hitherto found that the proper dimensions at sea-level for such an installation are 66 in. in diameter for a height of 90 ft. Applying our rule, set forth above, we find from the chart that r for 8,000 ft. is 1.357. Hence the proper height is 122 ft. at this altitude, and since r raised to the 2/5th power is found from the chart to be 1.130 the proper diameter is 74.5 in.

The authors realize that a considerable portion of the material in this article has appeared in these pages previously, but to insure a full understanding of the new charts, now presented here for the first time, is was necessary to collect and reproduce some of the earlier data.

DRAFT PRODUCED BY CHIMNEY 100 FEET HIGH IN INCHES OF WATER
Average Temperature of Chimney Gases 500° F.

Flue gas per hour, lb.	Diameter of chimney in inches																			
	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	132	144	156	168	180
20,000	**.55**	.62																		
30,000	.42	**.55**	.60																	
40,000	.21	.46	**.56**	.61																
50,000		.34	.49	**.57**	.61															
60,000		.19	.42	**.53**	.59	.61	.63													
80,000			.23	.43	**.53**	.58	.61	.63												
100,000				.29	.45	**.53**	.58	.61	.63	.64										
120,000					.35	.47	**.54**	.58	.61	.63	.64	.65								
160,000						.31	.43	**.52**	.56	.59	.62	.63	.64	.65	.65					
200,000							.30	.43	.50	**.55**	.59	.61	.62	.63	.64	.65				
250,000								.30	.41	.49	**.54**	.57	.60	.61	.63	.64	.65			
300,000									.31	.41	.48	**.52**	.56	.59	.61	.63	.64	.65		
350,000											.40	.47	**.52**	.56	.59	.58	.62	.63	.65	.65	.66
400,000												.42	.48	**.52**	.56	.60	.62	.64	.65	.66
450,000													.43	.49	**.53**	.58	.61	.63	.64	.65
500,000														.44	.49	**.56**	.60	.62	.64	.65
550,000														.39	.45	.53	.58	.61	.63	.64
600,000															.41	.50	**.57**	.60	.62	.63

Figures in bold type represent draft for chimney of least first cost.
For other heights multiply the draft given in the table by the height above the point at which the draft is to be determined, and divide by 100.

Problem Course in Electricity

BY H. H. BLISS

(Why does a generator have to be ventilated, and what is the relation between the temperature of the windings and the resistance? These and other problems dealing with generator efficiencies are taken up here in the seventeenth of a series of articles, and solved in a practical way for the man who wishes to understand his own plant.—The Editor.)

LOSSES, DROPS, AND REACTIONS

Tests of Losses.—By running a generator and taking readings of volts and amperes under various conditions of load, etc., one can obtain figures useful in calculating its various losses of energy. It is particularly valuable in this connection to have some way of measuring the mechanical input to the machine, such as a "transmission dynamometer" or a direct-connected motor of which the efficiency is known.

By a preliminary measurement one finds the resistance of the armature and of each field winding, using direct current from a battery or another generator and reading volts across and amperes through each part of the machine. Thus with a circuit such as that in Fig. A the voltmeter reading between **B** and **C** would be used in finding the ohms in the series coil; that between **D** and **E** (voltmeter leads touching commutator bars close to the brushes) in finding the ohms in the armature; that between **C** and **F** minus that between **D** and **E** in finding the contact resistance between brushes and commutator. If there is a shunt across the series field, this method gives the combined resistance of the coils and the shunt, which is the figure needed in calculating losses. When the generator is running the ohms in the shunt field are readily found by voltmeter and ammeter readings.

If a test is now run with the shunt field excited from an outside source and no current flowing in the armature, the total input evidently goes into losses due to friction, hysteresis and eddy currents. These frictional and iron losses, which are grouped together under the title of "stray loss," are thus determined as a whole by a single reading of the transmission dynamometer or by calculation from the input of the driving motor. If desired the excitation may be cut off and another reading made of the input, which will determine the friction loss. The total iron loss then equals stray loss minus friction loss.

Example.—After these measurements are completed, the approximate efficiency of the machine at any load may be calculated as shown in the example below. It is to be noted that the stray loss is nearly constant at all loads, since the friction does not change and the iron losses vary only a little as long as the speed is maintained and the flux is held approximately uniform.

An a.c. motor of 86% efficiency takes 11.7 amperes at 221 volts and 81% power factor when driving an unloaded shunt generator which furnishes its own exciting current of 3 amperes. The resistance of the field circuit (including rheostat) is 40 ohms; the drop at the brushes measures 2.5 volts when load is carried and may be assumed the same at all times; the armature has .03 ohm. Find the stray loss and determine the efficiency when the machine delivers a current of 200 amperes at 120 volts to the external load. The input to the generator during the test $= 11.7 \times 221 \times .81 \times .86 = 1800$ watts. The loss in the field circuit is $3 \times 3 \times 40 =$ 360 watts; at the brushes 7.5 watts; in the armature copper $3 \times 3 \times .03 = .27$ watt. Hence the stray loss $= 1800 - 360 - 7.5 - .27 = 1430$ watts, approximately.

Under load the armature copper loss $= 203 \times 203 \times .03 = 1237$ watts; the brush contact loss $= 2.5 \times 203 = 507$; the excitation loss plus the stray loss = approximately 1800 watts (in reality slightly higher on account of the greater field current and magnetic flux necessary to hold up the voltage, as explained below). Hence, as the output is 24,000 watts, the input = output + losses $= 24{,}000 + 1237 + 507 + 1800 = 27{,}544$ watts, and the efficiency $= 24{,}000/27{,}544 = 87\%$.

Ventilation.—Since all the losses in a generator are caused by the changing of electrical and mechanical energy into heat, a number of B.t.u. are developed whenever a machine carries a load. Thus the temperature of the winding is raised, which increases the resistance in both armature and field and makes the copper loss still greater. The temperature ceases to rise only when the heat is eliminated from the machine as rapidly as it is produced.

For purposes of cooling, spaces called "vent ducts" about one-half inch or less in width are left between sections of the armature cores in both d.c. generators and alternators. The centrifugal currents

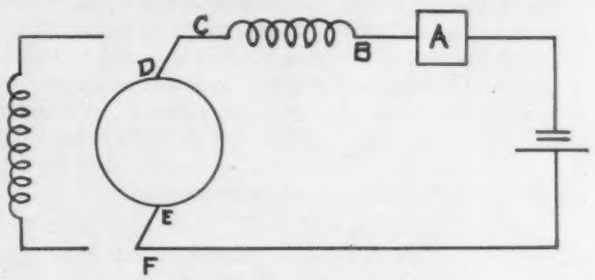


Fig. A.—Diagram of connections for testing resistances in a compound generator.

of air set up by the motion of the revolving parts blow outward through these spaces, cooling the iron and the inductors. In some machines special blades are built into the rotors to assist the fanning action.

How many B.t.u. per minute must be taken out of the generator in the example above by the ventilating air? How many cubic feet of air per minute pass through the machine if the air temperature is raised from 70° to 110° Fahr.? The losses total 3.54 kw., and each kw-hr. gives 3,412 B.t.u. Then

$3.54 \times 3412/60 = 201$ **B.t.u. per minute.** Since .02 B.t.u. warm one cu. ft. of air approximately 1°, $40 \times .02 = .8$ B.t.u. raise one cu. ft. 40° Fahr. (from 70° to 110°). Hence it takes $201/.8 = 251$ **cu. ft. per minute** to absorb the heat.

Temperature Rise.—Since a temperature of 190° Fahr., if continued, injures the insulating materials used on the conductors of a generator, it is custom-

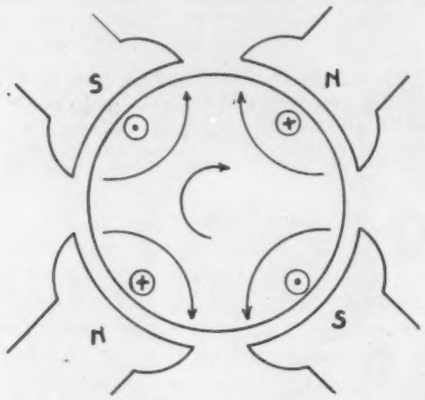


Fig. B.—The induced currents in an armature set up lines of force, of which the part in the armature iron is indicated in this sketch. This "armature reaction" interferes with the flux from the field poles.

ary to rate machines at such a number of kw. that the losses do not heat the wires to this extent. Of course any operation whatever raises the temperature, since the heat produced will not flow out until the temperature of the machine is above that of the surrounding air, and the rate of flow is proportional to this temperature difference. Hence generators are often guaranteed "to deliver the rated kw. with a rise not exceeding —— degrees above the room temperature."

For measuring the temperature, thermometers held in contact with the windings are sometimes used, and in other cases measurements of the resistances of the armature and field coils are made. These give a better indication of the average temperature through the coils. The calculation is based upon the fact that the ohms in copper increase by .2 of one per cent for each degree Fahr. rise. Sometimes small resistance units are built into various parts of the machine, and these give accurate information about the temperatures at those points.

Drop in Voltage.—In a d.c. generator armature of .03 ohm resistance there will be a drop of $100 \times .03 = 3$ volts when a current of 100 amperes flows, and hence the reading of a voltmeter at the brushes will be lower than the generated voltage by this amount plus the brush drop. There will be a further drop in the series field if one is used. Of course there is no drop in voltage unless current flows in the armature, so that at zero load a meter can read the generated pressure correctly, particularly if the current for exciting the field is not taken from the armature.

A shunt generator suffers a loss of flux when carrying load because of the decrease in exciting current when the voltage at the brushes is lowered. This results in a decrease in the induced pressure, so that the terminal e.m.f. is diminished by an additional amount.

To compensate for these various losses of voltage, most d.c. generators are equipped with the compound field winding. Alternators provided with voltage regulators are able similarly to deliver the same pressure to the line independent of the variation of the load. Both devices operate by altering the magnetic flux and thus raising the induced voltage whenever additional current is drawn from the armature.

Figuring Drops from a Test.—A "saturation test" of a generator may be made by exciting the field from a separate source and varying the exciting current through a wide range, no load being carried by the armature, which is connected to a voltmeter. A shunt generator thus tested was found to give the following voltages when the corresponding currents flowed in the 2,000 turns on the field magnets:

Generated Volts	100	110	120	130	140
Amperes in Field	4.0	4.7	5.8	7.1	8.7

The resistance in the armature = .02 ohm and the drop at the brush contacts = 1.6 volts when load is carried. Find the brush voltage at no load, at an armature current of 150 amperes, and again at 300 amperes, if the resistance of the shunt field circuit is kept constant at 20.7 ohms. (Disregard armature reaction, which will be considered later.)

At no load the small current to the shunt field does not cause an appreciable drop in either the armature or the brush contacts, hence the shunt current may be figured by dividing the generated volts by the ohms. Assuming 110 volts, we find the current = $110/20.7 = 5.3$ amperes, more than enough to give 110 volts; trying 120 volts gives $120/20.7 = 5.8$ amperes, just enough to generate 120 volts. Hence this is the voltage at zero load.

At 150 amperes the drop in the armature is $150 \times .02 = 3.0$ volts, making the brush voltage 4.6 volts lower than the generated e.m.f. If, then, 120 volts were generated, the field current would be $115.4/20.7 = 5.56$ amperes, which the table of test results shows to be too low to maintain 120 volts. For the purpose of interpolating in the table, note that $5.8 - 4.7 = 1.1$ amperes difference in current between 120 and 110 volts, or a decrease of 1 volt for a decrease of .11 ampere. Then, since 5.56 is .24 lower than 5.8, the corresponding voltage would be between 118 and 117. Taking the lower figure, the brush voltage would be $117 - 4.6 = 112.4$, giving a field current = $112.4/20.7 = 5.44$. This is about .33 lower than the current for 120 volts, hence the induced voltage is $120 - 3 = 117$, which checks on the assumption. Therefore the brush voltage for 150 amperes = **112.4 volts.** Similar methods give **106.4 volts** at the brushes for 300 amperes.

Adding Series Coils.—Suppose a series winding of a total resistance of .004 ohm is to be put upon the poles of this generator. How many turns should it have, to hold the terminal voltage at 120 when 300 amperes flow in the armature? (Assume the shunt field circuit to be connected to the machine terminals

so that it always has 120 volts across it; its resistance remains constant at 20.7 ohms.)

The drop in the series field = 300 × .004 = 1.2 volts; total drop in the machine = 1.2 + 6 + 1.6 = 8.8 volts, which means that the generated voltage must be 128.8. This could be accomplished by raising the shunt current by 1.14 amperes (7.1 — 5.8 = 1.3; 8.8 × .13 = 1.14), thus increasing the ampere-turns by 1.14 × 2000 = 2280. As the shunt resistance is not to be changed, however, the 2280 ampere-turns must be provided by the series coils; 2280/300 = **7.6 turns in the whole series winding.** In practice a whole number of turns would be employed, 8 or 10 or more, and the desired compounding secured by means of a shunt between the terminals of the winding.

Armature Reaction.—In the sketch of a d.c. generator in Fig. B there is shown the effect of the armature current in setting up lines of force other than the regular flux from the field magnets. The rule for direction of induced e.m.f. shows that the current flows down (into the paper) near the north poles, as indicated by the "+" marks (arrow feathers), and upward near the south poles, as indicated by the dots (arrow points). Ampere's fundamental right hand rule then gives the direction of the circling flux about these currents.

Remembering that lines of force issue from a north pole and enter a south pole, note that the armature flux opposes the field flux behind each inductor (thereby decreasing the number of lines entering the armature there), and assists the field flux ahead of each inductor (thus increasing the number of lines there). The result of this "armature reaction" is that the flux is skewed from its normal position as shown at the left of Fig. C to that shown at the right.

If it were not for the limited capacity of iron for carrying lines of force, this would make little difference in the total flux cutting the inductors. However, the partial abandonment of some of the pole tips is equivalent to decreasing the size of the pole shoes and so diminishes the total flux. In d.c. generators without such special devices as "interpoles" or "compensating windings" it is furthermore necessary to shift the brushes forward to help in commutation, and this permits the armature reaction to oppose the field flux still more effectively, so cutting down the flux and the induced voltage to a considerable extent.

Alternators as well as d.c. machines suffer from armature reaction. In both types of generator its bad effects may be minimized by designing the machines with wide air-gaps, though these require extra ampere-turns in the field coils.

Solutions of Previous Set

179. Average turn is 52 in. long and 500 turns would have a total length of 26,000 in. = **2,167 ft.** Resistance of one coil = 26,000/26,250 = .99 ohm (since No. 6 wire has 26,250 C.M.). Amperes = 8,000/500 = 16; volts per coil = 16 × .99 = 15.8 and total across field = **158 volts.**

180. Watts per coil = 15.8 × 16 = **253.** External area = 10 × (14 + 16 + 14 + 16) = 600 sq. in.; hence 253/600 = **.421 watt per sq. in.** The length and depth of magnet coils are calculated from the outer dimensions of insulated wire. Double cotton covered wire has a diameter of 12 mils greater than bare wire in sizes No. 16 and larger; 10 mils in sizes No. 20 and smaller, and 11 mils in sizes between 16 and 20.

181. Total shunt field loss = 220 × 16 = 3,520 watts; loss in rheostat = 16 × (220 — 158) = **992 watts,** which is 28.2% of total shunt loss.

182. Current = 250/50, or 5 amperes. Number of turns is 6,000/5 = 1200, or **300 turns per pole.** Total loss = 250 × 5 = **1,250 watts,** and the power absorbed in the rheostat = 5 × 5 × 8 or **200 watts.**

183. Section area = 24 × 100 × 400 = 960,000 sq. mils; 960,000/.785 = 1,220,000 C. M. Resistance of one inductor and end connection = 100 × 11/(12 × 1,220,000) = .0000751 ohm. Loss in armature = 72 × .0000751 × amperes × amperes = **12,150 watts** at 1500 amperes; **3,040 watts** at 750 amperes; **19,000 watts** at 1875 amperes.

184. The induced current flows in such a direction as to oppose the change of flux which causes it. That is, it opposes the weakening of the magnet, which means that the eddy current flows in a direction to strengthen the magnet. Hence the magnet current must have been flowing clockwise, making the upper end a **south pole.**

185. 60 × .015 = **.9 volt;** 90 × .010 = **.9 volt;** 200 × .005 = **1.0 volt.** Thus it is seen that the drop between commutator and brushes is approximately the same, independent of the load, after the brushes have time to acquire a temperature corresponding to the load.

186. 90 × .015 = **1.35 volts;** 200 × .015 = **3.0 volts.** Similarly the drop will be less than .9 volt if the load is suddenly decreased after the brush is heated by heavy current.

187. **54 watts; 81 watts; 200 watts; 121.5 watts; 600 watts.**

188. Four poles mean 2 cycles per revolution, or 30 r.p.s. or 1800 r.p.m. From chart, watts per inch = 62; 24 × 62 = 1,488 watts = **1.49 kw. = 1.98 hp.**

189. Watts = 600; watts per inch = 50; a straight line on the chart from 440 r.p.m. through 50 watts per in. strikes the diameter line at **4¾ inches.**

190. Watts = 1418; area of each brush = 1.31 sq. in. and of 60 area = 78.7 sq. in. Brush pressure = 1.97/1.31 = 1.5 lb. per sq. in., and hence the formula holds true without modification: watts = .0025 × area × diameter × r.p.m. Therefore r.p.m. = 1418 ÷ (.0025 × 78.7 ×36) = **200 r.p.m.**

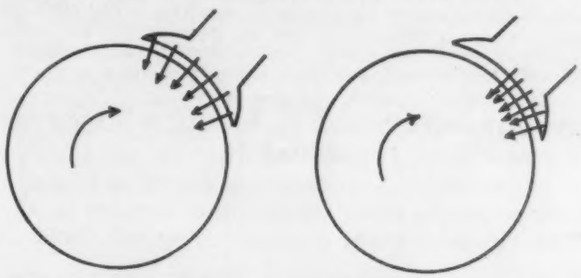


Fig. C.—At the left is shown the flux in an unloaded generator; when heavy current flows in the armature it tends to force the flux to one side of the pole shoe, as shown at the right.

191. Take for example sheets .1 and .2 inch thick. If 1 volt is the e.m.f. induced in the first, 2 volts will be induced in the second. The current in the thinner sheet has to flow across the armature and back again within a space of .1 in., hence each stream of current is limited to .05 in. Assuming that the path has a total resistance of 2 ohms, the current = .5 ampere in the thin sheet, and the power loss is .5 watt. In the thicker sheet the resistance is ½ as great, or 1 ohm, and the current is therefore 2/1 = 2 amperes; power loss = 4 watts, or 8 times as great as before. However, since one of the thick sheets replaces two of the thin ones, the total loss with the thick sheets is only four times that with the thin ones.

192. Since the "net length" of the iron is 10 in., the volume of the teeth = 2/3 of 10 × .785 × (47^2 — 45^2) = 5.23 × (2209 — 2025) = 962 cu. in. There being 60 cycles per second, the loss here = 962 × .031 × 60 = **1790 watts.** Volume of other iron = 10 × .785 × (50^2 — 47^2) = 2285 cu. in. Loss = 2285 × .019 × 60 = **2,610 watts.** Total loss = **4.4 kw.**

193. Eddy loss in teeth = 962 × .403 = **388 watts;** in body of armature it is 2285 × .231 = **528 watts.**

New Problems

194. A test of a generator gives the following readings for terminal volts and load current. State what kind of a machine it is and by interpolation find the volts for loads of 36, 70, 135, 145, 160 and 195 amperes.

Volts	550	575	595	605	600
Amps.	0	50	100	150	200

195. In a certain shunt generator the resistance in the armature and brush contact is .004 ohm and in the field circuit 11 ohms. Find the voltage generated and the armature and field copper losses when the machine delivers 1500 amperes to a load at 220 volts.

196. Sketch a south pole of an alternator field revolving counter-clockwise and show the effect of armature reaction.

197. Five hundred 40-watt, 110-volt lamps are connected to a compound generator 200 feet away by No. 0000 copper wires. The shunt field is connected to the machine terminals and has 20 ohms resistance; the series field has .01 ohm. What is the voltmeter reading at the brushes and at the generator terminals?

198. A six-pole shunt generator, run at 400 r.p.m., has a multiple winding with a total of 900 inductors. The armature resistance is .008 ohm and the voltage drop at each brush contact is 1.1 volts when load is carried. If the useful flux per pole is 4,000,000 lines, find the voltmeter reading at no load.

199. When the armature current in the above generator is 800 amperes, with the field current the same as before, the brush voltage is found to be 226.4. What is then the generated voltage and how much is it diminished by armature reaction? What is the flux per pole crossing the air gap?

200. An a.c. motor of 80% efficiency takes 60 amperes at 110 volts and 70% power factor when driving a 600-volt shunt generator through a 95% efficient belt drive. Find the stray loss in the generator if it supplies its own exciting current of 2 amperes.

201. When the above generator delivers 100 amperes to a load the brush drop is 3 volts. Find the efficiency if the armature resistance is .15 ohm. (Assume excitation and stray loss constant and neglect armature reaction.)

202. Through this generator there flow 750 cu. ft. of air per minute, entering at 85° Fahr. What is the temperature of the air as it leaves? (Take .017 as the B.t.u. required to raise 1 cu. ft. of air 1° Fahr.)

203. Derive a formula or rule connecting the watts loss with the cubic feet of ventilating air per minute and the temperature rise in the air. (Take the number .017 as in the previous problem, since it is more accurate than the approximate figure, .02 B.t.u. per cubic foot per degree.)

BOY SALESMEN IN A "FILL YOUR SOCKETS" CAMPAIGN

A novel campaign for filling empty sockets was featured during the entire month of January by the Utah Power & Light Company, over two hundred

Boys who took part in the "fill your sockets" campaign conducted by the Utah Power and Light Company. The boys proved apt and successful pupils.

boys, many of whom were members of the various Boy Scout organizations throughout the territory of the company, being enlisted as salesmen. While the Boy Scout organizations were asked to furnish boy salesmen for this campaign, for the reason that these organizations could be depended upon for boys of first-class character, the boys did not participate as Boy Scouts, but simply as boy salesmen.

Each boy was equipped with a supply of lamps of standard sizes, and the sales were made by a house-to-house canvass in the residence districts.

One of the newspaper advertisements used in the "fill your sockets" campaign, pointing out the advantages of full sockets and spare lamps, and heralding the arrival of the boy salesmen.

Sales were handled either for cash or the securing of a written order signed by the customer, authorizing the amount to be charged to the customer's account. The boys were paid a commission of 10% on their sales.

Advertisements were carried in some of the local newspapers, which were of material assistance in paving the way for the boys to approach the housewives.

Regular company salesmen in the various divisions posted the boys as to selling arguments, and most of them showed considerable "pep" and enthusiasm, and ability to bring these points to the attention of the housewives in a convincing manner, which resulted in very satisfactory sales in the towns of the larger divisions of the company.

U. S. CHAMBER OF COMMERCE SEEKS TO STOP CANCELLITIS

After investigating the epidemic of "cancellitis" which recently swept the country, the United States Chamber of Commerce has stated that it believes that this epidemic is one of the contributory causes for the slump in business. To prevent a recurrence of "cancellitis" and to help restore confidence the Chamber of Commerce has put out the following suggestions:

"Draw contracts in conformity with the law of the state in which they are completed or accepted—making the obligations of both the seller and buyer equitable, and provide in them for arbitration in case of dispute.

"Incorporate questions in your credit inquiries, the answer to which will establish the applicants' cancellation record.

"Consider it a duty and a privilege in protection to American business standards to report on inquiry those who unjustly and habitually disregard their contract obligations.

"Establish an Honor Roll of those who have dealt with you for a term of years according to contract or terms—and let them know why.

"Stand for 'Golden Rule' policy throughout your business, taking loss if necessary to demonstrate you mean it."

SPARKS—Current Facts, Figures and Fancy

(Do you know how heavy the air of London is, and which is the longest road in the world? Have you taken out fire insurance or ridden in the New York subway? If you are a shipbuilder, a fisherman, or a commuter you will find items of interest in the miscellaneous collection presented below.—The Editor.)

The longest road in the world is the Lincoln Highway, connecting New York and San Francisco. It runs through twelve states and is 3,284 miles long.

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The first vessel to be electrically welded throughout, which was launched in England a year or so ago, recently completed 10,000 miles of service without mishap.

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The number of electrical enterprises in Japan is estimated at 779. Of these, 685 furnish light and power, 41 electric street car service, and 53 power and street car service.

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The New York subway has the distinction of having carried about three times as many people as there are on the earth — 4,300,000,000 passengers since it began business.

* * *

The world's largest wireless station is now under way in France. The plant will be capable of sending 24,000 words an hour, and of receiving 60,000 words an hour. It will be able to communicate with all existing wireless stations in the world.

* * *

The toy-making business in the United States has increased by more than $25,000,000 in less than six years, while during the same period the imports of foreign made toys have decreased by approximately $3,000,000.

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The amount spent for building construction work in New York State during 1920 was $320,213,604. This is the highest amount the state has ever expended for building in any one year, surpassing the expenditure of the previous year by $16,936,301.

* * *

Newspapers and periodicals published in the United States last year are said to have consumed some 3,000,000 tons of paper, manufactured from over 100,000 acres of timber. And this does not include the amount of letter paper used to discourage poets.

* * *

The safety factor in civil aviation is illustrated by figures from England which, for the first year of civil flying in that country, reveal a total air mileage of 734,200, made in 38,954 flights, carrying 70,000 passengers with but one fatal accident. Five hundred and nineteen machines were registered.

* * *

It is estimated that every week in the year 1,600 dwellings, 3 theaters, 3 public buildings, 12 churches, 10 schools, 150 apartment buildings, 2 hospitals, 26 hotels, 2 college buildings, 3 department stores, 2 asylums and 2 jails are destroyed by fire in the United States, with a loss of 300 lives and $10,000,000 in money value. Multiplied by 52, this makes a formidable annual record.

* * *

These ten-year guarantees have been put entirely in the shade by a pumping engine discovered recently by an English paper. This machine was made by James Watt and was in active service for 135 years, pumping a drydock on the Clyde. It was removed only because the dock was closed. It is now to be removed, however, and placed in a museum.

* * *

It is estimated that $4,200,000,000 was spent on electrical goods and service in the United States during 1920. This was divided as follows: central stations, $900,000,000; electric traction, $800,000,000; telegraphy, $250,000,000; telephony, $550,000,000; electric manufacturing, $1,250,000,000; isolated plants, $200,000,000; miscellaneous, $250,000,000.

* * *

Of the 2,404 kilometers of double track line in France totally destroyed during the war, all have been completely reconstructed. To restore normal traffic along these lines it was necessary to rebuild 1400 signal towers, culverts and small bridges. Electrification, which started last year, has progressed rapidly, and orders have been placed for fifty new locomotives of the type used on the Chicago, Milwaukee & St. Paul railroad.

* * *

An automatic instrument for measuring the amount of impurity in the atmosphere of London has added to the fame of London's already famous climate. The device is operated by clockwork, filtering two litres of air at short intervals and retaining and weighing the suspended impurities. London fogs, no less than 200 to 300 tons of sooty matter, were suspended over the city. A "heavier-than-air" machine in this locality would have to be a battleship.

* * *

A new use for petroleum is in the preparation of a dip for preserving fishing nets. The nets are simply dipped in the solution, which is exceptionally penetrating, and acquire all the durable qualities hitherto obtained through the use of coal tar or tan bark. In addition, the brown color imparted to the nets by this new preservative eliminates all shadows visible to the fish. Fishing nets cost from $150 to $5,000, and their preservation is of great importance to the fishing trade.

Builders of the West—XCVII

MINING and agriculture have been called the two basic industries because the material welfare of the world depends upon the products which come directly from the soil. No nation can live without food, neither can it prosper or advance without raw materials for manufacture.

A large part of the history of the West is a chronicle of mining, and of mineral development. Today, the mineral wealth of the West, which has been located and explored by our pioneers, is one of our greatest national assets.

We are all familiar with the romance of the mining of an earlier day, when methods were crude and the object was to "get it while the gettin's good." Mining was a great and fascinating gamble. We are not as familiar perhaps with the generation of miners who have taken the element of speculation out of our mining ventures, and have made them sound investments. Trained engineers, bankers and business men, they have handled the funds of countless investors, and by their shrewd and courageous work have strengthened the economic structure of the nation.

F. W. BRADLEY

President of the Bunker Hill & Sullivan Mining & Concentrating Co., a leader among those whose energy and enterprise have been devoted to opening up the great mineral resources of the West, putting them on a sound financial basis, and making them available to industry.

To F. W. Bradley, one of the best known and best equipped engineers in the West, who has been connected with innumerable companies and who has been uniformly successful, not only for himself but for his clients, and whose efforts toward stabilizing the mining industry have been likewise crowned, this issue of Journal of Electricity and Western Industry is affectionately dedicated.

Fred Bradley was born in Nevada county, California, in 1863, and spent his boyhood among the old mining camps in that vicinity. His father was county surveyor and, by constant practice in scrambling in and out of gulches, and up chaparral hillsides, young "Fred" became his assistant, and later was appointed United States Assistant Deputy Surveyor and located many of the mines in that territory for patent.

It was probably the practice he received doing this work that earned him the title of the "champion walker of Nevada county." Mr. Bradley admits today that his prowess stood him in good stead when it later became necessary, at times, to sneak the bullion from the "cleanup" out, through the hills at night, to safety.

He entered the College of Mining at the University of California in 1882, and took a special course at that institution. He completed his studies in 1884 and returned to his home county as assayer and roustabout at the Eagle Bird Mine.

From here on, the career of F. W. Bradley is "just one thing after another." In two years he was one of the best known men in the mining industry in California. It all came about through the old Spanish Mine located at Washington, Nevada county. For years this mine had lost money, and about the time that Mr. Bradley appeared on the scene, had gone into the hands of its creditors. He journeyed to San Francisco and persuaded the creditors to make him superintendent. Then, in a day when college-educated miners were ridiculed, this youth fresh from college proceeded to hang up production records which not only satisfied the creditors but made a substantial profit. He astonished the old-timers by milling "sixty-cent ore" at a profit, by the use of Huntington mills, and established some remarkable records in operating costs.

In 1890, after five years' successful operation of the Spanish Mine, he became assistant manager of the Bunker Hill and Sullivan Mining and Concentrating Company, located in Idaho. In 1897 he became president of the company and through his successful guidance it has become one of the best known lead producers.

By this time the name of F. W. Bradley was well known in the mining world, and upon the death of Capt. Thomas Mean, he was chosen as consulting engineer and later as president of the operation of the London Exploration Company.

Although Mr. Bradley has been engaged in various mining enterprises, including lead, zinc, tungsten and copper, his specialty has been gold mining, and he is best known not as director of various banks, and president of commercial concerns, but through his connections as president and managing director of the Alaska Treadwell, Alaska Juneau, Alaska Mexican and Alaska United group of mines.

Mr. Bradley's success is attributed by his associates to his power to attract able men to him as subordinates, whose unquestioned loyalty has proved his absolute "squareness," and to the enthusiasm and tenacity by which he fairly overwhelms a problem and stays with it until he has mastered it.

PERSONALS

E. N. Hurley, of the Hurley Machine Company, Chicago, and formerly chairman of the U. S. Shipping Board and president of the Emergency Fleet Corporation, is in Los Angeles on a vacation. Mr. Hurley was a guest at a recent luncheon of the San Francisco Electrical Development League, and in a brief address emphasized the need of educating the public at large as to the essential service that is being performed by public service industries. Co-operation of all who have the particular interest of the industry at heart is necessary if the public is to work with and support the utility commissions, who, Mr. Hurley feels, are in need of this support and good will. Originality and business ability enabled Mr. Hurley to establish the pneumatic tool industry in this country and in Europe, and he was the organizer and president of the Standard Pneumatic Tool Company, of Chicago. In 1908 Mr. Hurley organized the Hurley Machine Company, manufacturers of electric washing machines, vacuum cleaners and ironing machines, and in this way has become well known in the electrical industry.

Robert H. Neuman, until recently a senior of the Southern Sierras Power Company's students course, has been appointed local superintendent of the company's Corona (Cal.) office.

J. W. Ellington, traffic manager of the Utah-Idaho Railroad, with headquarters at Ogden, has resigned, effective March 1, to become traffic manager of the Amalgamated Sugar Company.

A. H. Dimock, city engineer, Seattle, on February 28 gave an illustrated lecture on the "Swan Lake Impounding Reservoir" before the Seattle members of the A. S. C. E., at the Engineers' Club.

A. G. Mott has recently resigned as assistant engineer of the Southern Pacific Company, with whom he has been associated nearly twelve years, and has accepted an appointment as assistant engineer with the California Railroad Commission.

Harland Bartholomew, zoning expert of St. Louis, recently addressed the Seattle city zoning commission, and spent several days in Seattle advising with the local commission in regard to its zoning problems. Major Jesse A. Jackson is the secretary of the Seattle zoning commission.

Albert Hauptli, Jr., Chicago representative of Journal of Electricity and Western Industry, is in San Francisco for a two weeks' business visit. He will visit Los Angeles and return to Chicago by way of Portland, Seattle and the Inter-Mountain district.

E. H. Ball, president of the Chicago Belting Company of Chicago, one of the largest and oldest belt and leather specialty manufacturing companies in the United States, was a Seattle visitor recently. He was the guest of the local office of W. H. Ward & Company, exclusive agents in this territory of the company's products.

J. H. Wooll has completed the installation of the fuel oil storage system at the Pearl Harbor Navy Yard, T. H., for Chas. C. Moore & Co., Engineers, and, after nearly three years' construction work in the Islands, will be connected with the San Francisco office of the company during the month. The contract at Pearl Harbor consisted of a 12-inch oil line with an elaborate design of oil heaters, coolers, pumps, and an automatic electrically operated Foam fire protection system.

Ross Beason, traffic manager of the Salt Lake & Utah Railroad, generally known as the Orem Electric line, has resigned from that company to engage in the investment banking business. He will head the newly organized firm of Ross Beason & Company, with offices in Salt Lake City and New York. The new firm will confine its activities to the purchase and sale of railroad, utility and government bonds. Mr. Beason, however, will continue to be identified with the Orem Electric railroad, as vice-president and a director of the road.

Charles F. Muller, for the past four years assistant general manager of the Utah-Idaho Central Railroad, with headquarters at Ogden, Utah, has tendered his resignation, effective March 1. Mr. Muller has accepted a position with the Bee Hive Advertising Company at Salt Lake City, as assistant general manager. Mr. Muller will be succeeded by **David S. Romney**, formerly traveling freight and passenger agent of the Bamberger Electric Railroad at Salt Lake City. Mr. Romney has been connected with the Bamberger road for the past seven years.

Manson F. Backus, president of National Bank of Commerce; **Fred S. Stimson**, president and owner of the Hollywood Farms and president of Pacific International Livestock Exposition; and **D. E. Skinner**, president of the Skinner & Eddy Corporation and widely known in the Northwest as a lumberman, have been appointed as members of the local Supervisory Committee of the $100,000,000 Foreign Trade Financing Corporation launched last December under the auspices of the American Bankers' Association. Mr. Backus was asked by John McHugh, chairman of the Committee on Organization of the Foreign Trade Finance Corporation, to act as chairman of the Supervisory Committee for Seattle. The Foreign Trade Financing Corporation was chartered January 28 by the Federal Reserve Board, and its establishment is the result of two years of study of the foreign trade situation by a special committee of the American Bankers' Association.

William H. Crawford, manager of the Department of Industries, Chamber of Commerce, Portland, Oregon, has recently returned from a trip to Pacific Coast ports where he was investigating industrial conditions. His first employment was the Baldwin Locomotive Works of Philadelphia and from there he went with the Oriental agents of this concern, Frazer & Co., making his headquarters at Yokohama, Japan, returning to Philadelphia after two years' sales and engineering experience in Japan. Shortly afterwards Mr. Crawford returned to San Francisco where he became connected with Charles C. Moore & Company. In 1908 he opened the Oregon district office for this concern and remained in charge until July, 1915, when he left the employ of the Charles C. Moore & Company to become sales manager for the Simmen Automatic Railway Signal Company of Buffalo, New York. Mr. Crawford went East but within two years returned to Portland, where he has undertaken the important work of "selling Portland," industrially.

Harry L. Harper, first president of the recently organized Electric Club in Los Angeles, entered the service of the Western Electric Company in the capacity of shipping clerk for the Kansas City house at the age of seventeen. Two years later he was made warehouse foreman and progressed from that to telephone salesman. He advanced through various positions to his present one of manager of the Los Angeles branch. Mr. Harper is always to be found where there is something happening in the electrical field. He is a member of the Cooperative Campaign Advisory Committee. The electrical club of similar nature in central California, known as the San Francisco Electrical Development League, now has over five hundred members and has definitely announced its intention of going after one thousand. Under the able leadership of Mr. Harper, the electrical industry in the West may well feel assured that the Electric Club in Los Angeles will not be found wanting in comparison to the San Francisco organization in enthusiasm, vision or numbers.

C. O. Poole, chief engineer, Southern Sierras Power Company, has recently made a trip to San Francisco for business purposes.

F. J. Frank, of the Blumauer-Frank Drug Company, has been elected president of the Associated Industries of Oregon, at a recent meeting of the board of directors.

Noel B. Martin has resigned as superintendent of the Sherman Electric Company of Oregon, and will practice engineering in Lewiston, Idaho. **Roy F. Dean** of La Grande will succeed him as superintendent.

K. A. Macomber, of New York, identified with the storage battery division of the Western Electric Company in a consulting and advisory capacity, is in Seattle and expects to be in this territory for about a month.

T. G. Whaling, general manager of the Westinghouse Lamp Company, accompanied by R. W. Murphy, Pacific Coast manager of the same company, is making an extensive business trip throughout the Western states.

S. G. Clark has been appointed district manager of the California-Oregon Power Company at Grants Pass, Oregon. Previous to the recent promotion Mr. Clark served in the commercial department at Medford, Oregon.

John J. Muir, until recently connected with the United States Shipping Board, Emergency Fleet Corporation, has opened offices in Seattle and will practice as a consulting engineer in marine and general engineering work.

Richard Jessup, representative of the Western Electric Company, sailed recently for Japan, from San Francisco. Mr. Jessup's mission in the land of the rising sun will be the explanation of new electrical inventions to the Nipponese.

H. A. Mustard, of the General Lead Batteries Company, of Newark, N. J., manufacturers of Titan storage batteries, is expected in Seattle shortly on a business and inspection trip. Mr. Mustard is covering the entire Pacific Coast section.

Frank Rieber, inventor of X-Ray apparatus with headquarters in Berkeley, California, has returned from a recent trip where he gave an exhibition of his inventions, together with Professor Coolidge, inventor of the Coolidge tube, before the American Roentgen Society.

J. G. De Remer, research engineer of San Francisco, has left for New York City to remain indefinitely in the eastern metropolis. Mr. De Remer has spent the last two years in perfecting research on a new electrical refrigerator, which has great promise for domestic uses in the home electrical.

E. S. Kassler, President of the Nevada-California Electric Corporation, is in Southern California for a month, arriving in Riverside from Denver with his family in time to attend the annual meeting of officers and employes of the Southern Sierras Power Company and associated companies.

Thomas L. Wilkinson, for the past ten years in charge of the operating department of the Intermountain Railway, Light & Power Company, has retired from that department to resume consulting work. He will specialize in the design and construction of power and industrial plants, investigation of public utilities, and appraisals and valuations. Mr. Wilkinson's offices will be in Denver.

F. P. Dexter, connected with the accounting department of the Stone & Webster Corporation in the Boston offices, was a Seattle business visitor recently. Several years ago Mr. Dexter was general accountant for the Puget Sound district for the Puget Sound Power & Light Company. When he was transferred to the Boston offices of Stone & Webster, his place was filled by F. W. Brownell, who still holds the position.

R. B. Laymen, formerly local superintendent of the Southern Sierras Power Company at Corona, California, has been promoted to the newly created position of general storekeeper for the entire system, including the Nevada-California Power Company, operating in southwestern Nevada, Holton Power Company, the Imperial Ice and Development Company, and Holton Inter-Urban Railway, in the Imperial Valley, and associated companies. His headquarters will be at Riverside.

R. C. McFadden, recently appointed district manager of the Southern California Edison Company at Oxnard, Cal., was born at Placentia, Cal., Oct. 21, 1887. Upon completing his course in electrical engineering at Stanford University in 1910, he was employed by the Tacoma Railway & Power Company, one of the Stone & Webster properties. He remained with the Stone & Webster organization until 1916 when he entered the commercial department of the Pacific Light & Power Corporation of Los Angeles, giving special attention to the development of that company's electric range and water heater load. Following the consolidation of that company and the Southern California Edison Company in 1917, Mr. McFadden was transferred to Ventura where his duties were enlarged to include the development of the power load in that territory. During the war he enlisted in the naval service, and was discharged with an ensign's commission. On his return he was sent to Long Beach on power sales work. He was later made acting manager in that district, which position he held up to his appointment as district manager the first of this year.

OBITUARY

Robert W. Nicol, founder of the Capital Electric Company, and president and general manager of that concern until two years ago, died February 22 at a hospital in Salt Lake City. Mr. Nicol was born in Quincy, Ill., and for thirty-five years was identified with the electrical contracting business. He was well known throughout Utah, Idaho and Montana. He retired from active business two years ago, when the Capital Electric Company was sold to the General Electric Company.

HAPPENINGS IN INDUSTRY

COLORADO POWER COMPANY ASKS FOR RATE INCREASE

A petition has been filed with the Colorado Public Utilities Commission for an order permitting the Colorado Power Company to charge increased rates for power in its central system as an emergency relief measure, pending final determination of a case involving the company's power rates which has been before the commission for some months.

The company previously filed schedules increasing power rates in December, 1919, which were suspended by the Utilities Commission, which at the same time ordered the company to file an inventory of its entire property in Colorado.

The value of the property as set forth in the inventory is $9,819,233, based upon original costs. The value upon a basis of reproduction is $18,641,971.

In its petition for emergency relief the company asserts that if the rates asked for are permitted the increased revenue will not yield a net return in excess of 6 per cent.

SEATTLE CITY COUNCIL OPPOSES STATE LEGISLATURE HOUSE BILL 174

The Seattle city council recently went on record as opposing the enactment by the state legislature of House Bill 174, which would, in effect, according to Seattle city officials, transfer control from the city of Seattle to the State Director of Public Utilities of all city utilities, with the exception of the water department, and would seriously hamper the development of the Skagit River power project by the city of Seattle.

This bill, which provides that no public utility company or public service corporation be allowed to extend its service into territory already served by an existing utility corporation, without first securing a certificate of public necessity from the Director of Public Utilities, has already passed the House and is now in the Senate. The Seattle city council's legislative committiee composed of William Hickman Moore, Oliver T. Erickson and John E. Carroll, headed by Superintendent of Lighting Department J. D. Ross, made a special trip to Olympia and personally appealed to members of the Senate to kill the measure or so amend it that it will not interfere with Seattle utilities owned by the municipality.

BUFFELEN LUMBER & MANUFACTURING COMPANY OF TACOMA TO BUILD POWER PLANT

Work on construction of a new power plant for the Buffelen Lumber & Manufacturing Company, Tacoma, which will cost approximately $150,000, has been started. The power plant proper will be two stories in height, fireproof construction. A battery of five water-tube boilers of 350 hp. and an Allis-Chalmers 2,000-kw. turbine generator, have already been ordered and will be placed in the new power plant. In conjunction with the new power plant will be a large tool storage room, which will be built just back of the power plant, and which will include a system of conveyors and blowpipes, constructed to carry the refuse and dust to the shed. The building will be L-shaped. Generator and turbine room will be 30 x 100 feet, and the boiler room 100 x 150 ft. The storage shed will be 50 x 150 ft. When the plant is completed and in operation, it is proposed to sell the two old power plants now used by the company.

The new $160,000 veneer plant of the company is rapidly nearing completion, and experts who have charge of the work of construction assert it is one of the largest veneer plants in the country. Fir doors and three-ply material are the main products of the plant, although a large amount of finishings and mouldings of all kinds are manufactured. This company has been operating two sawmills, a door factory, and three large veneer lathes on the tide flats in Tacoma for several years.

LOS ANGELES UNION TERMINAL EXPANDS

A building permit in the amount of $1,000,000 has been issued for a new unit to the Union Terminal project, which will bring the total investment in this enterprise up to $10,000,000 and will add 450,000 square feet of floor space to the present area. The new work will consist of a seven-story, Class A, concrete building, 600 feet long and 100 feet wide, and will be completely equipped for wholesale businesses of all kinds and for the trans-shipment of commodities. Special equipment will be in the nature of electric elevators, conveyors and chutes. There will be a public cold-storage plant of 1,000,000 cubic feet of storage space, a public warehouse and a market court. At the present time there are 125 concerns doing their entire business at this terminal.

PORTABLE LIGHTING EXHIBIT DEMONSTRATED IN CALIFORNIA CITIES

The gospel of correct industrial and commercial lighting is being spread throughout the state by the California Electrical Cooperative Campaign.

So effective have been the demonstrations of the lighting exhibit at the Safety Museum of the Industrial Accident Commission in San Francisco that a portable exhibit, very similar to the permanent one, is being transported from town to town by Wm. F. Brainerd, field representative of the Campaign. Sacramento was the first point at which this portable exhibit was installed and from there it went to Stockton. The routing planned for it after it leaves Stockton is Modesto, Fresno, Bakersfield, then south of the Tehachapi, then north again by the coast route.

Through the advertisements of the contractor-dealers, through direct mail invitations, and through publicity stories in the newspapers, interested parties are advised of the exhibit, and by continuing the demonstration nightly for a week in each city everyone interested has an opportunity to attend.

NEW PLANT TO SUPPLY DEMAND OF WASHINGTON INDUSTRIES

New industries having taxed the present plant's capacity, the Northwestern Power and Manufacturing Company of Port Angeles, Washington, has started construction of a new $300,000 unit to produce 4,000 horsepower.

The present plant, which is located on the Elwha river, five miles west of Port Angeles, supplies Bremerton, Charleston, Port Angeles, Port Townsend, Bremerton navy yard and all of the industries on Ediz Hook Spit.

BOND ISSUE FOR WIRELESS STATIONS

To enable the Federal Telegraph Company to secure $500,000 with which to defray the expense of constructing four wireless stations, the Railroad Commission has authorized the issuance by the company of first mortgage 8 per cent serial gold notes aggregating half a million dollars. The stations are to be built on this coast, one at Palo Alto, one near Portland, Oregon, one near San Diego and one near Los Angeles.

SNOW IN THE SISKIYOUS

Snow on the 60-kv. line of the California-Oregon Power Company near Dunsmuir, Cal. Snow has collected on the wire to the depth of twelve inches—a cause of interruption of service where transmission lines are in mountainous country.

ELECTRIC HEATING SERVICE HELD DISCRIMINATING BY IDAHO COMMISSION

In denying a petition by the Idaho Power Company to make a change in the application of rate schedules applied to domestic and commercial air and water heating the Idaho Public Utilities Commission asserted that the continuation of electric heating service would be discriminatory if the installation required to carry the heat load were demanded by other types of service and the heating service could not, because of its cost, be supplied at less than a prohibitory rate. An increase in electric heating rates was held to be equitable where the service was originally offered and accepted in competition with coal and the cost of coal had greatly increased since that time.

PACIFIC FRUIT EXPRESS BUILDING LARGE PLANT AT OGDEN, UTAH

Construction work is progressing rapidly on the new ice plant of the Pacific Fruit Express at Ogden, Utah, and the plant is expected to be completed and ready for operation in the early part of May.

Electric power will be used in the company's operations at the new plant, and their initial requirements will be approximately 1,500 horsepower.

The building is of concrete construction, and when completed will be large enough to store 20,000 tons of ice. The manufacturing plant will have a daily capacity of 3,000 tons. The cost of the new plant, including new trackage, etc., will exceed $1,000,000.

PORTLAND RAILWAY LIGHT & POWER COMPANY'S GOLD NOTE ISSUE SOLD IN 12 DAYS

There were approximately 3200 purchasers of the $1,000,000 gold note issue of Portland Railway Light & Power Company, placed on the market February 14. The offering was taken and considerably oversubscribed in the brief period of 12 working days. The fact that most of the purchasers were residents of the community served by the company was particularly gratifying, as it demonstrates that they recognize the material benefits that will accrue to the community as a whole from their support of local enterprises that are substantially concerned in the continued development and upbuilding of the community.

The notes were sold entirely through the agency of the 2800 employes of the company, who acted as salesmen and themselves were heavy purchasers.

ELECTRICALLY OPERATED MILL IN ABERDEEN

The Anderson-Middleton mill in Aberdeen, Washington, recently completed the installation of a 1,500-kw. turbine of the Allis-Chalmers type, which cost complete approximately $48,000. A. A. Brown, chief engineer of the plant, reports that the work of electrifying the plant, which will be the second electrically operated lumber mill in the Grays Harbor district, will begin at once. Work of erecting a 175-ft. brick smokestack at the mill, to cost between $10,000 and $15,000, was started recently.

ANNUAL BUYERS' WEEK SCHEDULED

The Ninth Annual Buyers' Week, sponsored by the Portland Chamber of Commerce, will be held April 1 to 6, according to decision of the Buyers' Week executive committee.

Buyers' Week has become one of the big annual events of Portland. Started nine years ago under the auspices of the Chamber, it has grown to immense proportions and has done much to make Portland one of the greatest jobbing centers on the Pacific Coast. Hundreds of retailers from all sections of the Pacific Coast come to Portland for this event to purchase supplies of goods for their establishments.

To make the week one of pleasure as well as of business, Portland merchants have always provided many entertainment features for their guests.

It is the plan of the committee this year to make Buyers' Week more attractive than ever. Plans are being perfected for the event, and announcement will be made in the near future of the detailed program.

SOUTHERN CALIFORNIA EDISON COMPANY TO SPEND $48,000,000

Declaring that public convenience and necessity require the construction of certain reservoirs, conduits and power plants on the San Joaquin River and its tributary, Big Creek, the Railroad Commission has issued to the Southern California Edison Company a certificate under which it may proceed with a construction program that will call for the expenditure of approximately $48,000,000 in the next six years. The completion of this work will add to the hydroelectric generating system of the Edison Company a capacity of 316,000 kilowatts and an annual output of one and one-half billion kilowatt-hours.

The completion of the hydroelectric power developments and the utilization of the electricity generated thereby, the Commission says, "will add substantially to the power resources of the San Joaquin Valley and Southern California in supplying the constantly increasing demand for electricity for industrial, agricultural and commercial purposes." Continuing the Commission says:

> It appears that the demands for electricity in the territory now supplied by applicant are constantly increasing and must be met largely by the construction of new hydroelectric plants. The program herein contemplated will provide for the growth of applicant's business for an extended period in the future. The funds to be used in the construction of the facilities for the development of power herein proposed will be obtained from the sale of applicant's stocks and bonds.

The principal items of construction included in the proposed development are as follows:

1. Florence Lake Reservoir of 43,000 acre-feet capacity, located at the headwaters of San Joaquin River.
2. Tunnel eleven miles in length, connecting Florence Lake with Huntington Lake.
3. Conduit from Huntington Lake to Shaver Lake.
4. A new hydroelectric generating station known as Power House 1-a, above Shaver Lake.
5. Shaver Lake Reservoir of 138,000 acre-feet capacity, located on Stevenson Creek.
6. Conduit from Shaver Lake Reservoir to a generating station to be known as Power House No. 2-a.
7. A new hydroelectric generating station known as Power House 2-a on Big Creek.
8. A third generating unit in present Power House No. 1 on Big Creek.
9. Enlargement of hydroleectric generating station known as Power House No. 8.

UTAH-IDAHO CENTRAL ISSUES $300,000 NOTES FOR IMPROVEMENTS

The issuance of $300,000 in notes for the purpose of purchasing equipment and rolling stock and making improvements has been authorized by the board of directors of the Utah-Idaho Central Railroad, operating an electric line between Ogden, Utah, and Preston, Idaho. The notes are to be held by the large stockholders of the company.

The greater part of the money will be used in the purchase of freight cars for the purpose of taking care of increase in the livestock and sugar beet business of the towns along the line of the road.

The expenditure for the improvements will be made at once by the company. In fact, one hundred new steel gondola cars have been purchased from a Columbus, Ohio, firm and will be delivered to the electric lines within the next two months. The new cars are of the latest type and will have a capacity of 55 tons each. They will be used for the handling of sugar beets, coal, lime, rock, sand and gravel.

HYDROELECTRIC PROJECT PLANNED FOR ELEPHANT BUTTE DAM

A scheme is on foot to bring about the production of 33,000 hp. in electrical energy by the construction of three power plants on the Rio Grande—one at the Elephant Butte Dam, one at Tortugas and one at Canutillo. These plants, according to the promoters of the project, can be built for $4,000,000, will pay for themselves in less than ten years and thereafter will produce a net revenue exceeding $500,000 a year. The Elephant Butte Dam was completed under the auspices of the United States Reclamation Service in 1916 at a cost of $10,000,000 and has provided irrigation for approximately 80,000 acres of land. The proposal now submitted to the Reclamation Service is that if the United States will build a canal designed to double the present extent of the irrigation district, the farmers of the territory to be developed, in New Mexico and Texas, will finance and build the power system and furnish power to the government for the purposes of the project at cost. The city of El Paso will extend the canal to its boundaries and pay for its share of the benefits to be derived from carrying out the plan described.

NEW PLANT TO SUPPLY DEMAND OF WASHINGTON INDUSTRIES

New industries having taxed the present plant's capacity, the Northwestern Power and Manufacturing Company of Port Angeles, Washington, has started construction of a new $300,000 unit to produce 4,000 horsepower.

The present plant, which is located on the Elwha river, five miles west of Port Angeles, supplies Bremerton, Charleston, Port Angeles, Port Townsend, Bremerton navy yard and all of the industries on Ediz Hook Spit.

SAN JOAQUIN L. & P. CORP. DEPOSITS COLLATERAL

An order by the Railroad Commission authorizes the San Joaquin Light & Power Corporation to deposit, as collateral to secure the payment of 90-day notes, $2,375,000 of its first and refunding mortgage bonds. Moneys obtained through the transaction are to be used to finance in part construction expenditures.

WASHINGTON WATER POWER COMPANY TO BUILD HYDROELECTRIC PLANT ON SPOKANE RIVER

It has been recently announced that the Washington Water Power Company will construct a plant at Spokane to generate 14,500 horsepower. The plant will cost about one and one-half million dollars. One feature will be a reinforced concrete penstock 18 feet in diameter which will carry water to the water wheel. This will be one of the largest in the country when completed.

MUNICIPALITIES DISCUSS POWER DEVELOPMENT

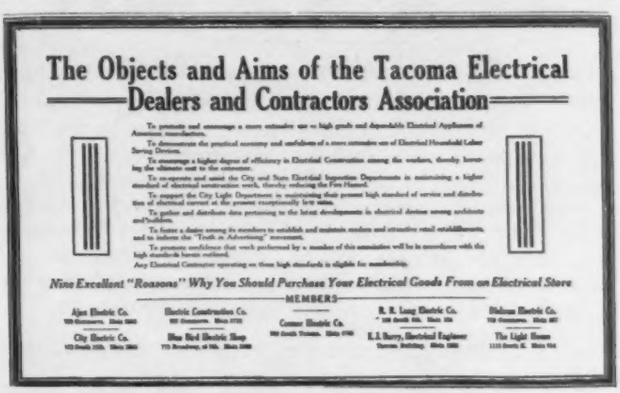
H. A. Mason, secretary of the California League of Municipalities, and Colonel R. B. Marshall were the principal speakers at the conference of the southern members of the League, held in Riverside on February 22.

Mr. Mason, who is advocating the adoption of the Ontario plan of electric distribution, urged the cities represented at the conference to take advantage of their privileges under the new Federal Water Power Act and file on power sites. His program is to have the various smaller cities unite in groups, which, in his opinion, would enable them to conduct an extensive power development.

The meeting adopted the motion to have the various representatives return and present the matter to their city boards, who in turn are expected to authorize the appointment of trustees, and this board of trustees will undertake the work of locating and filing on water-power sites.

Colonel Marshall explained in detail his plan for a complete irrigation system in the great valley of California which has already been presented to readers of the Journal. Following Colonel Marshall's talk the meeting endorsed a program which would combine the Ontario plan with the Marshall plan.

The following cities were represented at the meeting: Riverside, Los Angeles, Pasadena, Redlands, Santa Ana, Whittier, Fullerton, Corona, Orange, Monrovia, Santa Monica, Long Beach, San Bernardino, Glendale, and Alhambra.


The Objects and Aims of the Tacoma Electrical Dealers and Contractors Association

To promote and encourage a more extensive use of high grade and dependable Electrical Appliances of Approved manufacture.

To demonstrate the practical economy and usefulness of a more extensive use of Electrical Household Labor Saving Devices.

To encourage a higher degree of efficiency in Electrical Construction among the workers, thereby lowering the ultimate cost to the consumer.

To co-operate and assist the City and State Electrical Inspection Departments in maintaining a higher standard of electrical installation work, thereby reducing the Fire Hazard.

To support the City Light Department in maintaining their present high standard of service and distribution of electrical current at the present exceptionally low rates.

To gather and distribute data pertaining to the latest developments in electrical devices among architects and builders.

To foster a desire among its members to establish and maintain modern and attractive retail establishments, and to inform the "Truth in Advertising" movement.

To promote confidence that work performed by a member of this association will be in accordance with the high standards herein outlined.

Any Electrical Contractor operating on these high standards is eligible for membership.

Nine Excellent "Reasons" Why You Should Purchase Your Electrical Goods From an Electrical Store

MEMBERS

Ajax Electric Co. — Electric Construction Co. — Conner Electric Co. — R. R. Long Electric Co. — Holman Electric Co.

City Electric Co. — Blue Bird Electric Shop — E. I. Berry, Electrical Engineer — The Light House

SELLING CONTRACTOR-DEALER ASSOCIATION TO THE PUBLIC
A good type of advertising run in the Tacoma papers by the members of the Tacoma Electrical Dealers and Contractors' Association

CHICAGO COMPANY HAS UNIQUE SCHOOL

The Edison Electric Appliance Company of Chicago has recently inaugurated a school to promote "intricate salesmanship" and stimulate better and more intensive methods of selling. The course is offered to all electrical dealers and jobbers gratis, and consists of a correspondence course covering the principles of salesmanship, advertising, and the fundamentals of electricity.

LOS ANGELES RAILWAY IMPROVEMENTS

Plans have been completed by the Los Angeles Railway, operating the "yellow" cars in that city, which call for the expenditure of $2,500,000 as soon as the proposed work has been authorized by the Railroad Commission. Four new substations will cost $500,000; a similar amount will be spent for a new car house; renewals of overhead equipment will cost $300,000, and the balance will be spent largely for new track and repairs. The company has also launched a building program to provide homes for employes, this feature of the work to be under a separate corporation which will be self-supporting.

TRANSCONTINENTAL RADIO SIGNALS IN MOVING AUTOMOBILE

Signals sent out by Atlantic Coast radio stations were received recently by apparatus carried in an automobile moving along the streets of San Francisco. The demonstration was made in connection with the automobile show being held in that city, and is said to be the first time that such long-range signals have been received by light portable equipment of this sort.

The antennae consisted of stranded copper wire aerial hung about 10 ft. above the ground by bamboo poles at the front and rear of the automobile. Nothing but the frame of the machine was used for a "ground." The signals were clearly audible without the use of amplification, only one bulb being used. Except for a six-volt storage battery the receiving set was entirely contained within a small cabinet of about the same size as an ordinary suit case. The set was not specially made up for this purpose but is a standard product turned out by a San Francisco radio manufacturer.

The first tests were made on top of Twin Peaks, an eminence in a part of the city where power lines and street cars would not interfere with the signals. The test was so successful there that the automobile was driven down into the city, and the signals continued to be clearly audible even when the automobile was driven close to electric cars in operation. Some of the Atlantic Coast stations heard were Marion, Mass. (W.S.O.), Annapolis, Md. (N.S.S.), New Burnswick, N. J. (N.F.F.), Pearl Harbor, Hawaii (N.P.M.). E. A. Portal of the Colin B. Kennedy Co., conducted the demonstration.

GORGE CREEK PLANT OF SKAGIT RIVER PROJECT TO BE RUSHED TO COMPLETION

The city of Seattle has awarded contracts to the Westinghouse Electric & Manufacturing Company, and the S. Morgan Smith Company, to install hydroelectric equipment at the Gorge Creek plant of the Skagit River project. The contracts total $1,164,000. The city has sold $1,000,000 6% bonds, at par, to finance the construction of this unit. The plant will develop 48,000 horsepower, which will be available in ten months.

Trade Notes

New Los Angeles Plant —

The Western Cooperage Company, owned by Woerner Bros. with offices in Portland and San Francisco, announces a proposed expenditure of $250,000 for a new plant in Los Angeles.

American Blower Co. Opens Offices in San Francisco

C. H. Cochrane, Pacific Coast manager of the American Blower Co., has recently opened up offices in the Rialto Building, San Francisco.

Washing Machine Agency Moves —

A. M. Smith Company, handlers of the Apex Electric Washing and Ironing Machines, electric vacuum cleaners, and the Singer sewing machine and other labor-saving devices, has moved from 215 Mercantile Place to 219 West Third Street, Los Angeles.

Eastern Firm Opens in Great Falls —

The Premier Service Company has purchased the stock and location of the Great Falls Electric Supply Company. The Premier company is a subsidiary of the General Electric Company. The contracting business of the retiring company has been taken over by the State Electric Company.

Majestic Electric Development Co. Elects Officers —

At the regular annual meeting of the stockholders of the Majestic Electric Development Co. the following directors and officers were re-elected for the coming year:

President, E. N. Brown; vice-president, M. H. Shoenberg; secretary, T. D. MacMullen. Directors—E. N. Brown, M. H. Shoenberg, T. D. MacMullen and B. C. Brown.

Apex Prices Guaranteed to June 1 —

The Apex Appliance Company, Oakland, California, has announced that it will guarantee all dealers and customers against any decline in price up until June 1, 1921. Even then "it is problematical," the announcement reads, "if there will be any decline." This action is taken in order to impress upon the trade that there is no foundation for the prevailing opinion that Apex washer and ironer prices are coming down.

Globe Commercial Company Moves —

The Globe Commercial Company, manufacturers' agents, have removed their offices in San Francisco from 618 Mission Street to 709 Mission Street. This company, of which Max Loewenthal is president, are the Coast representatives for Tideman Electric Manufacturing Company, Signal Electric Manufacturing Company, Russell Electric Company, Empire Transformer Company, Mueller Electric Company, Wise McClung Manufacturing Company, Auto Vacuum Freezer Company, and various other factories.

Jeffrey Dewitt Insulator Co. Expands Plant —

Commemorating the lighting of their second kiln at their million-dollar plant at Kenova, the Jeffrey Dewitt Insulator Company recently celebrated with a banquet the christening, at which officials of the company, officials and members of the Chamber of Commerce, and others participated in the christening of the installation of the new unit.

The company, according to statistics made public at the banquet, occupies 13 acres of ground and employs 150 men. Under the new arrangements the company will establish export business in Japan and France, and will employ 30 per cent more men. With the operation of a new kiln the capacity of the plant will be doubled.

Appointed Sales Agents for Hevi-Duty Electric Furnaces —

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., have been appointed exclusive sales agents in the United States, its possessions, and Canada for the line of Industrial Hevi-Duty Electric Furnaces manufactured by the Electric Heating Apparatus Company, 123 Sussex Avenue, Newark, New Jersey.

The standard heavy duty industrial furnaces include 12 different sizes from 18 in. wide, 24 in. long, 13½ in. high inside dimensions, capacity 22 kw., up to 32 in. wide, 17 in. long, 16 in. high, capacity 80 kw. Either automatic or non-automatic temperature control is supplied. This line will be extended as developments warrant.

Westinghouse Builds New Experimental Laboratory —

Owing to the trend toward higher voltages which is being initiated in the West, and which will ultimately extend to all parts of the United States, the Westinghouse Company is building a complete, modern, high-voltage, experimental laboratory. In this laboratory will be installed two transformers, one rated at one million volts, 1,000 kva., the other rated at half a million volts, 500 kva. They can be connected together, and one and a half million volts can be obtained between terminals. This will allow voltages for flashover testing as high as one and a half million volts.

The laboratory will be 120 feet long, 110 feet wide and 50 feet high, without columns of any sort. High-voltage insulators, transformer terminals and circuit breaker terminals will be tested in this plant.

MEETINGS OF INTEREST TO WESTERN MEN

(Cooperative organizations hold important meetings throughout the West. Electric Club of Los Angeles is organized. Southern Idaho Electrical Dealers' Association is formed. California Industries Association holds an "Electrical Luncheon."—The Editor.)

California Industries Association "Electrical Luncheon"

At the "Electrical Luncheon" of the California Industries Association held at the Palace Hotel, March 3, over three hundred and fifty members and guests heard "The Story of Water Power and Its Message to Industries," and an opportunity was given to meet "The Maid of the Mist." Joseph Thieben, chairman of the day, introduced N. H. Sloane, manager of the California Industries Association, who briefly stated the purpose of the association. The meeting was then turned over to Robert Sibley, editor of Journal of Electricity and Western Industry, as master of ceremonies. The spectacular presentation to "The Maid of the Mist" followed Mr. Sibley's introductory remarks. On a screen was shown the waterfall, in the mist of the fall "The Maid"; at the command of the master of ceremonies the maid came forth, symbolic of the youth and vivacity of California's wonderful water power.

W. E. Creed, president of the Pacific Gas & Electric Company, was introduced. Extracts from his talk follow:

W. E. CREED,
President, Pacific Gas and Electric Company, who said: "We must educate our people that their interests lie in cooperating with the public service industry — when it deserves cooperation."

"The surest underwriting of any community, any state or any nation, is industry—and industry depends upon two fundamental factors. Those factors are population and power. The state of California began its existence from a small population and no industries except agricultural and mining because of our lack of population. As population developed, the need for industries and the possibilities for industries became apparent. With the discovery of cheap oil, the increase in industries from 1909 down to 1915 was four times as great as the rate for the entire United States, and today California's production in volume and value of industrial production is more than all the other ten Western states combined.

"That development is directly traceable to the development of population and power, which came from cheap oil, is apparent. The day of cheap oil has come, but we who are interested in the industrial development of this state must relieve the oil industry so that it may discharge its obligation in behalf of demands for which it has no substitute. If we are to relieve the oil industry from some of the burdens, we must develop our water power of which we have more, and far more, than our fair share. You will see what importance is attached to the possession of the means of power by the way those great nations of Europe have fought and for which their sons have died—to possess coal and oil, because coal and oil mean power. With power and population, railroads and industries will come, because the combination of these fundamental factors is bound to produce industry. The population makes the market and furnishes the labor, and the power turns the raw material into usable products.

"We have here in California, as I have said, more than our fair share of the water power of this country. If we could have our people educated to what that power means to us, development would proceed and California will attain its destiny.

"The greatest difficulty which exists in the whole public service industry, including the power industry, is the overcoming of the negative influences which surround the public service industry today. My experience as a man in the public service has led me to the conclusion that there is no greater obligation resting on the man in that industry than to endeavor to educate our people that their own interests lie in cooperating with the public service industry—when it deserves cooperation.

"I think there is no business in the state of California, and no industrial activity in the state of California that is today conducted under any higher ideals or under any more unselfish ideals than is the public service industry as a whole.

"We are meeting today in this state one of those negative influences in this King Tax Bill. Our legislators are not thinking economically. The duty of the man in the power business is not merely to develop power—their duty is to develop cheap power.

"In the last ten years the population of this state has increased 44%, our taxable wealth 60%, and cost of government 244%. This is a direct process of strangulation, and unless our government thinks economically, unless they cease to tighten the rope around the throats of industries, industry will cease.

"The movement that should be brought about in this state is to bring the cost of government down to our taxable wealth or bring our taxable wealth up to the cost of government, and our taxable wealth is not going to increase unless we encourage industry and manufacture in this state.

"I think it can be said with truth that the power men in the state of California have done more than simply talk about power. They have proceeded to lay out definite, positive programs for the development of power in this state and those programs have been developed and outlined to take care of not only the increase in the power demands of this state, based upon the demands of the people, but in addition, to have power ready to relieve the oil industry in order that industry might devote its attention to those demands which it always can supply.

"In the past, fully 60% of the power used in this state has come from oil. The balance has come from water and from natural gas and coal, and the hydroelectric industry must gradually cut that 60% down until it becomes the great source of power for our industrial development.

"The money for these great enterprises, not only the power industry, but all of these public service industries upon which our industrial development depends, will come provided we have that spirit of cooperation, that public attitude toward industries which encourages capital. California is growing. It needs the capital of the country to attain its great destiny, and our attitude should be to protect that capital, to be fair always to capital, whether it be in corporate form or other form, and until we establish those public relations out of which comes a strong invitation to capital to locate in this state, we are not going to reach the low cost in our service which is so highly desirable in the development of this state."

A. Emory Wishon, general manager of the San Joaquin Light & Power Corporation and the originator of the "self-

interest" idea, presented pertinent facts showing the interrelation of power and industry. For each home built in the country two are built in the city. The shortage of power in the San Joaquin Valley retarded the expenditure of $10,000,000 for home building. Mr. Wishon emphasized the necessity of giving capital a fair deal, and the point that it is to the interest of the people that adequate power be available.

That the attitude of the public service industries had been revolutionized during the past ten years and that the corporations, once accused of abusing the rights of the public, were now emphasizing the fact that they were servants of the public, was stated by E. O. Edgerton, recently president of the State Railroad Commission. The public service industries are worthy of the support of every citizen and are in need of their support. This support will come if the truth be told in terms that can be understood by the public. The power companies have the ability and the brains needed to carry on the development of water power projects, and the capital will be forthcoming provided the capital be assured of fair treatment. This will result with an enlightened public opinion.

Capital Electric Company Elects Officers

At the annual meeting of the directors of the Capital Electric Company, held at Salt Lake City on March 1, the following officers were elected: J. A. Kohn, president (formerly vice-president and treasurer); H. D. Randall, vice-president; C. B. Richmond, treasurer; R. S. Folland, secretary.

Plans were outlined for the coming year, and a general spirit of optimism prevailed regarding the company's activities for the future.

San Francisco Electrical Development League Luncheon

At the regular Monday luncheon of the League Mr. E. N. Hurley gave timely and helpful remarks upon the problems confronting the electrical industry. The necessity as well as the desirability of an accurate and up-to-date system of accounting was presented in a forceful manner by Prof. Henry R. Hatfield, professor of accounting, University of California. Professor Hatfield emphasized the desire of the University to be of assistance in establishing modern accounting systems through the Extension department.

Denver Contractor-Dealers Urged to Cooperate

At a meeting held in Denver by the Denver Electrical Contractors' Association cooperation was urged by Laurance W. Davis, field representative of the National Electrical Contractors and Dealers' Association, who is now on tour of the West and who was the speaker of the evening. Mr. Davis asserted that the industry has not begun to reach its zenith as a factor in the advancement of science, and declared that within the next five years hundreds of new electrical appliances will have been placed upon American markets which are not thought of now.

Edison Crescent Bay Club Formed in Redondo

A new organization in Southern California is the Crescent Bay Club, which is composed of employes of the Edison Company in the Redondo Steam Plant and the Redondo commercial office. The club was launched in January and has a membership of 180. The club has a unique rule that no one having a position higher than that of foreman is eligible to hold office. Permanent headquarters have been secured at 117 El Paseo, Redondo Beach, where pool tables, player piano, card tables and a library may be enjoyed by the members. Study classes have been started as an important feature of the club work, with W. E. Thompson in charge as director of education.

New Mexico Electrical Association Convention

Truthful publicity as the best means of establishing harmonious relations between public utilities and the communities they serve was urged by J. F. Greenawalt, publicity manager of the Mountain States Telephone & Telegraph Company, before the annual convention of the New Mexico Electrical Association, held at Albuquerque on Monday and Tuesday, Feb. 14 and 15. Prof. R. W. Godard of the State College made an address on "Electricity," tracing its historical development and dwelling on the practical importance of technical research. "Electricity for the Bakery, Hotel and Restaurant" was discussed by J. F. Senior, who pointed out the large field afforded central stations by the electric range, which serves a business almost unaffected by hard times. Prof. Charles E. Carey of the University of New Mexico presented a paper on "Lightning and Lightning Protection," enumerating eight features in the design of lightning arresters which should be included or avoided and eight other factors which have an important part in assuring protection. A paper on the relationship of the jobber to the central station, by Hollis R. Johnson of the Commercial Electrical Supply Company, St. Louis, presented the business-getting problem from the jobber's point of view.

Oregon State Irrigation Congress Meets

The Oregon State Irrigation Congress held its annual convention in Portland recently with a large representation from the various irrigation projects in attendance.

The by-laws of the congress were changed, dividing the state into four districts, each district to be represented by a vice-president. Resolutions were adopted authorizing the executive committee to meet with the executive committee of the Oregon State Drainage Association to formulate a plan for the consolidation of the two organizations under the name of the Oregon Reclamation Association.

F. N. Wallace of Tumalo was re-elected president and J. Frank Spinning of Hermiston was re-elected secretary.

Utah Section of A. I. E. E. Holds Meeting

Mr. E. Bachman, of the General Electric Company, presented a timely and interesting paper on "Electric Arc Welding" at the meeting of the Utah Section of the A. I. E. E., held at the Commercial Club March 4th. The paper, illustrated by slides, covered the application, the results secured, the equipment used and the characteristics of the load. An exhibit showing the results of work done locally was included.

The Utah Electrical Contractors and Dealers' Association assured the Section of its support in entertaining the convention guests in June, and plans for the convention were considered.

Sixth Annual Meeting of Officers and Employes, Southern Sierras Power Company

"Better Public Relations" was the keynote sounded by Vice-President and General Manager A. B. West, of the Southern Sierras Power Company and Associated Companies, in his address opening the sixth annual meeting of officers and employes at Riverside, February 17th to 19th.

Possession of a definite objective and a program for its attainment, Mr. West pointed out, is essential to individual success, and the rule holds good concerning corporations. The greatest problem confronting the public service companies today is the betterment of relations between the people and the privately owned utilities.

Public relations, Mr. West insisted, are not the special province and concern of officials or any group of departments, but are the immediate and paramount business of every man and woman in the organization, in business hours and after business hours. The attitude of the public toward the corporations is largely influenced by personal contact with those who represent them in local offices and in the field.

The message to be delivered, asserted Mr. West, calls for neither sophistry nor camouflage. When the time comes that the people know the truth, the whole truth and nothing but the truth concerning the state-regulated public service

companies of California, an impregnable front will be presented by the latter to the attacks of the communist, the demagogue, and the doctrinaire.

Companies represented at the annual meeting were the Southern Sierras Power Company, the Nevada-California Power Company, Holton Power Company (operating in Imperial Valley), the Imperial Ice and Development Company, Holton Inter-Urban Railroad, Interstate Telegraph Company, Hillside Water Company, and Cain Irrigation Company. President E. S. Kassler of the Nevada-California Electrical Corporation was present from Denver, as was Comptroller W. C. Simmons of the same company.

Vancouver Electric Club Hears Address on "Electricity and Mining"

E. A. Haggen, British Columbia mining authority and editor of the Mining and Engineering Record, Vancouver, addressed the Vancouver Electric Club on "Electricity and Mining." Mr. Haggen said that if up-to-date electrical machinery, costing between $2,000,000 and $3,000,000, were installed in the Vancouver Island coal mines the price of coal would be $3 a ton less in Vancouver.

Mining in British Columbia represented an investment of $700,000,000 and had an output valued at $40,000,000 a year, which would be doubled in a few years. The growth of electrical industries was of the greatest importance to mining because of the use of copper and other metals. Mr. Haggen gave interesting descriptions of the employment of electricity for mechanical, electrolytic and metallurgical processes in mining. The only smelter in the world refining five different metals—gold, silver, lead, copper and zinc—by electrical processes was to be found at Trail, B. C.

The development of the Rossland mines and the Trail smelter had been the result of the development of hydroelectric power at Bonnington Falls on the Kootenay river. The West Kootenay Light and Power Company, operating the Bonnington Falls plants, was extending its lines westward to Princeton, a distance of 180 miles from the plant, and eastward to the Sullivan mine in East Kootenay, more than 100 miles. The westerly transmission line would use 110,000 volts.

Mr. Haggen told of mining projects which were developed solely as a result of electric power being obtained. A mine at Hedley, B. C., formerly depended upon coal for power and often was shut down. Since obtaining hydroelectric power, its operation was continuous.

Port Authorities Meet at Seattle in October

According to unofficial figures, one thousand delegates from the major shipping and industrial centers of North and South America, Europe, Asia and the Antipodes, are expected to come to Seattle for the annual convention of port authorities in October. A campaign begun months ago by the American Association and the Seattle Port Commission has progressed to the point where it is now virtually assured that numbers of foreign delegates will be in attendance. Dr. W. T. Christensen, of the Port Commission, which has charge of arrangements for the gathering, is now making plans for the entertainment of the visitors.

Association Formed by Southern Idaho Electrical Dealers

An association of electrical contractors and dealers of Idaho, to be known as the Southern Idaho Electrical Dealers' Association, was organized at an enthusiastic convention of a large number of representatives of the various Idaho branches of the electrical industry, held at Twin Falls, Idaho, February 20th.

The following officers were elected: Harvey Ball, of Burley, president; Walter Bauchmann, Idaho Falls, vice-president; B. J. Hetherington, Boise, vice-president; P. H. Bullock, Weiser, vice-president; Harry Dinkelacker, Twin Falls, secretary and treasurer.

It is felt that this organization will do a great deal toward promoting the get-together spirit among the electrical fraternity and will insure better service to the public. It has been started off with an unlimited amount of enthusiasm, and is the first organization of its kind that has been formed in Idaho for a long time. All of the local jobbers were present at the meeting, as well as a representative of the Montana Electric Company, and representatives of the manufacturers.

The next meeting of the association is to be held in Boise, Idaho, September 4 and 5, 1921.

COMING EVENTS

PACIFIC COAST SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION
Annual Convention—Del Monte, California, May 25-27, 1921

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Annual Convention—Salt Lake City, Utah, June 20-26, 1921

NATIONAL ELECTRIC LIGHT ASSOCIATION
Annual Convention—Chicago, Ill., May 31-June 2, 1921

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Spring Meeting—Chicago, Illinois, May 23-26, 1921

CALIFORNIA STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS
Annual Convention—Santa Cruz, June 16-18, 1921

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION
Annual Convention—Galveston, Texas, May 18-21, 1921

Electric Club Organized in Los Angeles

At an enthusiastic meeting held in the Jonathan Club on the evening of February 28, thirty members of the electrical fraternity in Los Angeles took the preliminary steps to form a permanent organization to be known as "The Electrical Club." Following the election of officers and the appointment of committees, it was decided to hold weekly luncheons at the Alexandria Hotel, Monday being selected for the meeting day.

This organization is the outcome of a series of conferences arranged by southern members of the Advisory Committee of the California Cooperative Campaign, and it is felt that the Electric Club will result in better fraternal relations among all the branches of the industry in Southern California. Arrangements were made for the first luncheon on March 14.

Following are the officers, executive committee and standing committees:

President, H. L. Harper, manager of Western Electric Company. Vice-presidents: A. W. Childs, superintendent of sales, Southern California Edison Company; J. C. Rendler, president Southern California Electric Company, and N. R. Powley, manager Southern California Telephone Company. Secretary-treasurer: F. J. Airey, manager Pacific States Electric Company. Executive secretary: E. F. Moss, secretary Contractor-Dealers' Association. Sergeant-at-arms: J. G. Pomeroy, manufacturers' representative.

Executive Committee: J. O. Case, General Electric Company; G. E. Arbogast, F. E. Newbery Company; A. B. Day, Los Angeles Gas & Electric Corporation; H. B. Titcomb, Pacific Electric Railway; E. L. Lewis, Los Angeles Railway; K. E. Van Kuran, Westinghouse Electric & Manufacturing Company.

Program Committee: K. E. Van Kuran, J. N. Colkitt, A. E. Morphy.

Fraternal and Attendance Committee: G. E. Arbogast, R. B. Clapp, I. F. Dix, P. G. Gough, Ross Hartley, J. C. Jones, C. E. Johnson, E. L. Lewis, J. E. McDonald, L. E. Moselle, E. R. Northmore, D. C. Pence, H. N. Sessions, C. E. Spaulding, A. B. Vandercook.

Publicity Committee: Carl M. Heintz, Dan B. Minor, C. H. Pierson.

Entertainment Committee (special occasions): W. L. Frost, H. W. Allen, R. H. Manahan.

Finance Committee: F. J. Airey, Paul D. Howse, Burdette Moddy.

Membership Committee: R. J. McHugh, H. E. Sherman, E. P. Markee.

Public Policy Committee: R. H. Ballard, R. J. Cash, Jr., C. B. Hall.

Visiting Committee: N. W. Graham, C. F. Baker, C. E. Listenwater.

Membership Executive Committee Meeting, California Industries Association

A meeting of the California Industries Association was held March 10, for the purpose of ratifying the action of the board of directors looking toward the federation of the Industries Association and the California Development Board. It has been felt that the two organizations would perform more efficient service if there was some definite link of coordination. Both are devoted to the support of existing industries and the development of new ones, although working along somewhat different lines. It is proposed to federate the two organizations, each for a time, at least, preserving its separate name and identity, with a view to later making one organization. The California Development Board held a similar ratification meeting March 11.

LATEST IN APPLIANCES AND EQUIPMENT

(Diesel engines have an important place in hydroelectric development. New type of electric outlet plug will support heaviest chandelier. Side outlets permit of dual use of electric light sockets.—The Editor.)

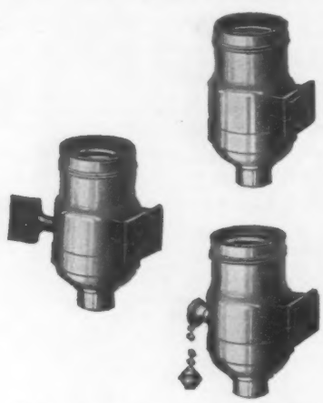
NEW ELECTRIC WAFFLE IRON

A new electric waffle iron has been placed upon the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Simplicity and ease of operation as well as sturdiness are the features of this waffle iron. The opening of the iron is accomplished by simply pulling down the handle of the iron, and the closing is accomplished by raising the handle. The waffle iron has a highly polished finish and is equipped with a through switch and tray.

New Westinghouse waffle iron

BRYANT SOCKETS WITH SPARTAN OUTLETS

The Bryant Electric Co., Bridgeport, Connecticut, have added to their line of wiring devices, key, keyless and pull sockets with side outlet of the Spartan standard style. As will be noted from the illustration, the side outlet is of compact design and does not increase the over-all length of the socket. The receptacle part of the combination socket does not interfere with the threaded bead on the socket so that it is possible to use a shade over the lamp if desired, the shade being supported by a Uno shadeholder which screws on the bead.



Side outlets to increase usefulness of sockets

In these sockets the usual porcelain insulation is replaced by molded insulation so that the slotted receptacle member and the socket base can be accurately assembled. Moreover, the receptacle member is not easily chipped or damaged as would be the case with porcelain.

The two outlets of these sockets are in multiple connection so that when the key or pull switch is operated to control the lamp, the circuit through the receptacle and extension cord therefrom is not disturbed. Thus it would be impossible to operate a fan or desk light through the side outlet without using the lamp in the socket.

All three of these devices have approved ratings of 660 watts, 250 volts on each outlet—ample for heating iron or percolator service.

NEW TYPE MOTOR DEVELOPED BY G. E. COMPANY

The General Electric Company has developed a new type of alternating current motor for operation on cranes and hoists, known as the M.T.C. These motors are designed to take the place of the former type M.T.C. and I.T.C. types, and have several features which are radical improvements over the old design.

They are generally smaller in diameter and longer than motors of the same horsepower, of the old design, which reduces the armature flywheel effect. They also have larger shafts and bearings. As to the electrical characteristics, at rated frequency and voltage, the maximum stationary torque is twice the running torque. All those 40-hp. and below are rated on a 30 minute, 50 deg. C. rise, and from 50-hp. up on a 60 minute, 50 deg. C. rise basis.

ELEXIT RECEPTACLE AND CEILING PLUG

"How heavy a chandelier will it hold?" is a question frequently asked about the new type of electric outlet plug that has made possible flexibility in the use of lighting fixtures.

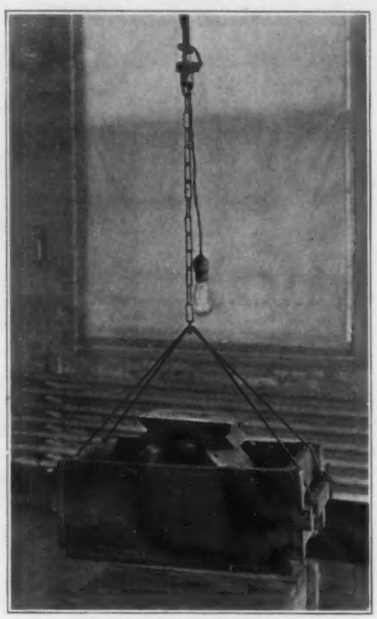
The answer was supplied by a recent tenacity test. These plugs are made in two pieces, which are inserted in the contact slots one at a time, the curved blades of each section pointing in opposite directions. With this method of insertion both the electrical and mechanical connections are made.

One of the plugs was placed in a ceiling receptacle. On the hook of the plug was hung a brass plated steel fixture chain, the links of which were 2 1/16 inches long and of .093 inch stock. On the other end of this strong chain was attached a heavy wooden box, and iron billets added. At a load of 192 pounds the chain parted. The test was continued with a steel chain, with links 1¾ inches long and of .110 inch round stock. This chain parted at 212 pounds. A steel cable was substituted for chain and more metal added to the box. At 310 pounds the plug clung to its receptacle with a bull-dog grip, firmly supporting the tremendous weight.

Thirteen more pounds of metal were loaded into the container. With this weight the bronze contact brushes of the receptacle bent so that the blades of the plug escaped from the supporting surfaces and twisted themselves out of the receptacle.

This test removed all apprehension as to whether the new installation method is successful as far as the question of support goes. The wall plug of the new plan is made on the same curved blade principle but the blades both point upward as they are inserted in the contact slots. These, too, have demonstrated that they are capable of sustaining all kinds of wall brackets without vibrating or working loose.

Homes, offices, hotels, hospitals and public buildings of all kinds will all be benefited by the advantages of the new flexible installation system. A number of the new electric outlets may be installed on the walls and ceilings of each room during the construction of a building. These are ready for the instant installation of any kind of electric fixture or appliance in any part of the room. Fixtures may be put up, or taken down, or replaced by a fan, or other appliance, in a few seconds' time, and of course without the aid of an electrician.



Elexit Receptacle supporting 150 pounds

DIESEL ENGINES IN HYDROELECTRIC STANDBY PLANTS

A recent bulletin of the Busch-Sulzer Bros.-Diesel Engine Co., of St. Louis, Mo., points out advantages which indicate that the Diesel type engine is the logical one to use as a standby source of power in large hydroelectric systems. In the first place, the annual charges against a Diesel plant are about one-third of what they would be against

a steam turbine plant: in the second, the cost of power is much less—about 500 kw-hr. per barrel of low-grade or California fuel oil; thirdly, the number of operators are less with a Diesel plant than with a steam plant of equal output. These and other advantages assure for Diesel type engines an important place in the field of Western hydroelectric development. The bulletin, and others dealing with Diesel engines for specific fields, can be obtained from the Western sales office of the Busch-Sulzer Bros.-Diesel Engine Co., in the Rialto Building, San Francisco.

A MIDGET MOTOR-CONNECTOR

For use on portable motor-driven devices such as massage machines, vibrators, sewing machines, vacuum cleaners and the like, the Bryant Electric Co. have developed the Midget Spartan Connector KR-130.

This connector is furnished in two parts—the plug or "cap" with parallel blades for fastening permanently to the

Convenient connection for small motors

motor, the receptacle being attached to the portable cord that supplies the current service wires. Both parts are made of molded insulation.

For motors where polarity connection is essential, the cap is furnished with non-reversible blades—one large blade to fit a large slot in connector, so that it is impossible to reverse the connections.

Books and Bulletins

Bureau of Standards

The Bureau of Standards has recently published Technologic Paper No. 175 under the title: "Pouring and Pressure Tests of Concrete."

Bureau of Mines Publications

Technical Paper 271 of the Bureau of Mines deals with state mining laws on the uses of electricity in and about coal mines. The paper was prepared by L. C. Ilsley and contains fifty-one pages, which should be of great value to the manufacturer of electrical equipment. This publication may be had by applying to the director of the Bureau of Mines at Washington, D. C.

Commonwealth Club Transactions

Waterpower and Irrigation is the subject of a recent report by the Commonwealth Club of California, which covers an investigation lasting many months, and contains much data and many recommendations of vital interest to those interested in the hydroelectric industry. The report is replete with charts and comparative figures and covers a comprehensive survey of the water situation, past, present and future.

The Right Book

"Use the Right Book in the Right Way and Make the Right Profit," is the statement which stands out in red type as an introduction to a large sized booklet which, by means of merchandising and advertising hints, tells the dealer in Mazda lamps how to bring his sales to the highest point. A number of small booklets presenting special subjects are announced and post cards are inserted for the ordering of advertising material.

Elementary Lessons in the Mathematics of Electricity

The William Hood Dunwoody Industrial Institute of Minneapolis have recently published "Elementary Lessons in the Mathematics of Electricity," which is the first of a series of three books to be printed on elementary electricity. The book is designed to meet the needs not of the electrical engineer but of the practical journeyman and of others connected with the electrical business needing an elementary understanding of the mathematics and laws, instruments and batteries of the trade. Hence the material will be found to be of value to schools training young men for entrance to the trade or giving extension work to those already employed in the business in any capacity. Large concerns carrying on corporation school work of their own will find these books to be of great help to their men.

J. G. White Eng. Corp. Issues Attractive Folder

"Achievement" is the name of a folder being distributed by the J. G. White Engineering Corporation, 45 Exchange Place, New York City. It gives information about and illustrations of power developments, hydroelectric developments, transmission systems, and other important engineering projects in this and in foreign countries.

Ohio Brass Co.'s New Catalog

The Ohio Brass Co. has recently issued a new catalog, No. 18, covering their line of electrical supplies. This is an illustrated and indexed volume of 638 pages. The following supplies are listed, with a complete line under each heading: porcelain insulators, pole hardware, trolley material, catenary material, bonds and tools, third rail insulators, and car equipment. All supplies are illustrated by half tones and, where necessary, with line cuts giving dimensions; a brief description of the article points out its uses and the advantages of design.

Income Tax

Robert H. Montgomery, C. P. A., has prepared the fifth annual edition of his "Income Tax Procedure, 1921" (New York: Ronald Press, 1921; 1205 p.). Vol. 2, Federal Excess Profits, Tax Procedure, and Vol. 3, New York State Income Tax Procedure, complete the set and will be off the press within a few weeks. These books are the standard manuals upon which many business people depend in making out tax returns. The Treasury Department rulings and court decisions made up to Jan. 15, 1921, are included in this edition. The laws are interpreted and the form of returns illustrated. The exposition is simple and concise and the author is an accepted authority on the subject.

Western Electric Bulletin to aid fan sales

Human Engineering

By Richard H. Mulliner, Manufacturer; member of the American Society of Mechanical Engineers; managing head of the firm of Mulliner Brothers, Manufacturing Service Engineers. 368 pp., 4⅞ x6¾. Published by Mulliner Bros., 445 South Warren St., Syracuse, N. Y.

Text book designed for the engineer's reference and study and for advanced students of human nature and worldly affairs. It gives the fundamental reasons why man must be controlled by carefully planned scientific methods and the underlying principles now governing the human element in the manufacturing and business world.

"Save With a Smile"

A new booklet, titled as above, designed to create a new interest in thrift and systematic saving, is being distributed by H. M. Byllesby & Company. Every page contains one or more quotations on the value of saving or thrift from famously successful men or leaders of thought. The first chapter is entitled, "Why We Should Save." Others are: "Thrift," "Compound Interest," "Investment," "An Easy Way to Save and Invest" (the Byllesby partial payment plan), "How to Judge an Investment," "Why This Is the Greatest of All Times to Save," and a final chapter on "Byllesby Sponsored Securities." A feature of the booklet is a compilation showing how rapidly wealth accumulates when certain sums are saved regularly and invested semi-annually at 7%. A copy of the booklet is being sent to the News Bulletin list. If additional copies are wanted, they will be sent upon request, by the Publicity Department, Chicago.

Westinghouse Street Lighting Circular

Circular 7A-C-2 has been issued by the Westinghouse Electric & Manufacturing Company, George Cutter Works, South Bend, Indiana, describing and illustrating the Westinghouse Luxsolite Fixtures for street lighting. Style numbers and data on these fixtures, together with prices, are given in this circular.

NEW ELECTRICAL and INDUSTRIAL DEVELOPMENTS

(In all districts throughout the West there are indications of a revival of business activities, particularly in new industrial developments, all of which call for electrical equipment and necessitate an increase in the production of primary power.—The Editor.)

THE PACIFIC NORTHWEST

MAPELWOOD, ORE.—The Commercial Club of Mapelwood has voted to install a system of street lights in the town.

LEBANON, ORE.—Lebanon Electric Light Co. has filed an application with the Public Service Commission asking for an increase in rates for service in this city.

VANCOUVER, B. C.—The city council has decided to install an ornamental lighting system covering the business district, and accordingly has appointed a committee to obtain estimates on the cost, style of posts and similar information.

PORTLAND, ORE.—Production of lumber by Portland sawmills in 1920 amounted to nearly 661,000,000 feet, the largest total for any year in local history. This was exclusive of shingles, boxes, veneer and other forest products not classed as sawed lumber.

PORTLAND, ORE.—Contract has been let by the Western Wool Warehouse Co. to Miller-Grier Co. for the first unit of the wool warehouse and scouring plant to be erected by this company on its three-acre tract on the waterfront at St. Johns. The contract price was $70,000.

SEATTLE, WASH.—The Seattle Lighting Department is offering for sale electrical equipment valued at $27,000. The equipment includes a 500, a 150, a 75 and a 50-kw. generator, and six 500-kva. transformers, all in first-class condition. Official call for bids will be made immediately.

SPOKANE, WASH.—The Electric Equipment Company, with stores at Colfax, Lewiston and Walla Walla, has been reorganized, A. M. Cash becoming president and manager. Vice-President K. G. Harlan resigned. A plan to separate the management of the stores was voted down. The headquarters will remain at Walla Walla.

TACOMA, WASH.—The main mill of the Marine Lumber Company was recently destroyed by fire, causing a loss in buildings, equipment and machinery estimated at between $125,000 and $150,000. The mill is owned by J. C. Cook and F. H. Skewis of Tacoma, with offices in the Tacoma Building. It is understood the plant will be rebuilt.

SEATTLE, WASH.—The Superior-Portland Cement Company, Seaboard Building, Seattle, reports that on Feb. 1, 1921, 150,000 square yards of concrete paving were contracted for in Washington, as compared with 50,000 yards on Feb. 1, 1920. It is unofficially estimated that there will be about 2,000,000 yards of concrete paving laid in the state during 1921.

OLYMPIA, WASH.—The Olympia Veneer Co., a new organization of Tacoma, Olympia, and eastern interests capitalized at $100,000, will begin work not later than March 15 on a complete veneer manufacturing plant to cost not less than $80,000. Between 30 and 40 men will be employed all the year round. The plant will be in operation by July first.

PORTLAND, ORE.—Sutton & Whitney, Portland architects, have work on the boards involving new structures to be built in this city to cost in excess of $3,000,000. The proposed buildings are: Scottish Rite Cathedral, $1,000,000; office building for doctors, $700,000; Ballou & Wright warehouse, $150,000; Meier & Frank warehouse, $1,000,000; Portland Sanitarium, $250,000, and Christian Science Home, $65,000.

WALLA WALLA, WASH.—The city commissioners and officials of the Pacific Power & Light Company have worked out tentative plans which provide for the city of Walla Walla owning its own street lighting system. The plan calls for creating assessment districts and installing an entire new system of lights, including arc lights in the residence districts.

TACOMA, WASH.—The city of Tacoma, through Commissioner of Lighting Ira S. Davisson, recently issued a call for bids for the construction of a light and water department building to be used for shop and storage purposes. The proposed structure will be two stories, of either mill or reinforced concrete construction, costing approximately $80,000. The structure will be located on Hood street, between 24th and 25th streets.

VANCOUVER, B. C.—The municipality of West Vancouver, population 2,500, has applied to the British Columbia Electric Railway Company for electric light and power. The population of this district, which is about four miles from Vancouver on the north shore of Burrard Inlet, is about doubled in summer. The company has hitherto declined to extend because the business is of a seasonable nature, but it is awaiting a census of customers to be taken by the municipality before replying to its request.

SEATTLE, WASH.—A. M. Castle & Company, dealers in steel and heavy hardware, recently leased storage space formerly occupied by the Skinner & Eddy Shipbuilding Corporation in Seattle, the transaction meaning the centering in Seattle of vast storage stocks of iron and steel. Seattle will continue to be the distributing point for these classes of materials for the states of Oregon, Washington, Idaho, Alaska and British Columbia. The company acquires in the new storage space 150,000 square feet of ground, with buildings valued at $400,000.

SPOKANE, WASH.—Four Inland Empire electric power companies with headquarters in Spokane, W. C. Eivyer being active in the direction, have declared dividends. The companies are: Grangeville Electric Light & Power Co. (north Idaho), dividends, $21,660.60; Okanogan Valley Power Co. (Wash.), $13,935.75; Des Chutes Power Co. (Ore.), $16,654.50; Enterprise Electric Co. (Ore.), $9,729. All the foregoing have been in exchange from eight to twelve years. Prior to the war the regular annual dividend was 8 per cent, but heavy corporation taxes since the war have compelled a reduction to 7 per cent.

SPOKANE, WASH.—The Chelan Electric Co., a subsidiary of the Great Northern Railroad, has entered into an agreement with the Chelan Falls Power Company for the purchase of the latter's 1250-hp. plant on the Chelan river for $125,000. The vendor company sells its power to the Wenatchee Valley Gas & Electric Company for distribution throughout the Wenatchee valley, which has several prosperous towns and cities and an intensively cultivated orchard area. The agreement has only just been filed for record although dated August 22, 1918, when the power plant was under construction. It is believed this indicates an intention on the part of the Great Northern Railroad Company to exercise the agreement in connection with the proposed construction of a huge power plant and dam on Lake Chelan.

THE PACIFIC CENTRAL DISTRICT

BISHOP, CAL.—A Pear Growers' Association has been organized in Owens River Valley, which plans to spend $50,000 during the next two years, advertising the region to prospective settlers.

RED BLUFF, CAL.—City Engineer W. F. Luning presented to the city trustees preliminary figures on the probable cost of establishing a municipal electric power and light plant for Red Bluff. The plant is to be located on Mill Creek and will cost about $170,000.

WILLOWS, CAL.—Construction of the drainage project of reclamation district No. 2047 will be continued. This district contains 250,000 acres and is one of the largest reclamation districts in the West, but no further work will be contracted for until after voting of a bond issue.

GRASS VALLEY, CAL.—The new power transmission line of the Pacific Gas & Electric Company from Colgate power house on the Yuba River to Grass Valley has been completed. This is the first unit of improvements in this county by the company which are to cost approximately $250,000.

MERCED, CAL.—The California Peach and Fig Growers will build the first unit of a packing house at Merced this season. The first unit will be approximately 80 by 120 feet. The work will go forward shortly as it is desired to have the plant in working order by August to handle the fig crop.

STOCKTON, CAL.—Ground has been broken by the Kroyer Motors Company, manufacturers of the Wizard tractor, for its factory building at Stockton. Construction of the plant will be rushed to permit its operation early in the summer. The first unit will be of the latest improved design for factory buildings.

PLACERVILLE, CAL.—The lumber mill of S. G. Beach & Sons started operations March 8, with a full crew of men. A large order of box shook which it will fill presages good times in the fruit industry of the county. There are five shook mills in the county and the others are expected to start operations at an early date.

SAN FRANCISCO, CAL.—San Francisco has a population of more than 600,000, according to a statement issued by the San Francisco Chamber of Commerce. The new directory issued by the telephone company is one basis of this estimate; other factors considered were the postage cancellation, bank clearings, and the number of gas and water consumers.

FALL RIVER MILLS, Cal.—The Pacific Gas and Electric Company tunnel to divert part of Fall River through a mountain to the Pit River side has been driven 1,000 feet by the contractor, Francis Rolandi. The tunnel will have a total length of 10,140 feet. Rapid progress will be made in the future, as a mucking machine has been put to work. This is a shovel loader operated by compressed air.

SAN FRANCISCO, CAL.—The Pacific Coast Dehydrators' League, to be composed of organizations dehydrating fruit and vegetables in commercial quantities, was formed March 9, at a meeting of representatives of the industry. From thirty to forty dehydrating concerns in California are qualified to become members, it was announced, many of the larger concerns already having enrolled, and others in Oregon who have expressed interest in the plan will be invited to join.

FRESNO, CAL.—An experimental vineyard, under control of the United States Department of Agriculture, will be maintained at Fresno. A bill authorizing the purchase was passed by Congress this week. Grafting and other viticultural experiments will be carried on with the idea of developing new varieties and finding use for wine grape vineyards that ranchers may desire to convert into raisin or table grapes.

TURLOCK, CAL.—Bids were received by the board of supervisors and Modesto Irrigation District, the bids being received on two alternatives: No. 1 for the construction of the dam, railroad to be furnished by the district; No. 2 for the construction of the dam, railroad to be furnished by the contractor. Alternative No. 1—R. C. Storrie & Co., Crocker Bldg., San Francisco, $2,421,354; Utah Construction Co., Phelan Bldg., San Francisco, $2,671,173. Alternative No. 2—Utah Construction Co., $2,680,708. Bids were taken under advisement.

THE PACIFIC SOUTHWEST

VICTORVILLE, CAL. — Southwestern Portland Cement Company has just installed a 400-hp. crushing mill, which will be held generally as a reserve unit.

BRAWLEY, CAL.—Figures compiled from the Pacific Fruit Express show that due to high freight rates and other costs, the spinach crop has proved an almost complete loss.

BLYTHE, CAL.—The Southern Sierras Power Company has installed at its plant a 150-hp. full Diesel Western engine, in addition to the 150-hp. Snow that has been generating the local supply of juice.

CHANDLER, ARIZ.—Irrigation bonds amounting to $2,000,000 in the Auxiliary Eastern Canal District carried without a dissenting vote. It is understood that Los Angeles people will float the bonds and as soon as they are sold construction will start.

BIG PINE, CAL.—Nevada-California Stage Company has been authorized by the Railroad Commission to operate an auto passenger, express and baggage service between Big Pine, California, and the Nevada state line, near Oasis, from where it will run to Tonopah.

SEARLES LAKE, CAL.—General cessation, or reduction of operations to minimum by the West End Chemical Company, Solvay Process Company and American Trona Corporation, is reported. Market conditions and state of exchange are given as reasons. Some hope of relief by Congressional action is entertained.

EL CENTRO, CAL.—Projects under way or about to start involve expenditure of $242,000 by the city and include paving, $85,000; Manual Arts High School, $70,000; rehabilitation place for disabled soldiers, $5,000; Eastside School, $32,000; reconstruction of Holton Power Company's distributing system, $50,000.

RANDSBURG, CAL.—California Rand mine is in high grade at the 500 level, a carload of ore recently shipped running more than $100,000. The motor driven compressor recently installed was expected to be in operation March 1. A mill for treating low grade ores is contemplated. The Swastika and Hicks mines are both in high grade ore.

LOS ANGELES, CAL.—Plans are under way for the erection of a huge coaling plant at Los Angeles Harbor. Utah coal will be brought into Los Angeles and served to ships engaged in world trade through San Pedro Harbor. Sweet Brothers Coal Company of Utah has made application for space in Los Angeles harbor for the erection of a cement coal bin and permission to operate an electric coal barge.

LOS ANGELES, CAL. — Shipment of citrus fruit to New York by water is not only cheaper, but more practical than by rail. This is according to a wire received by citrus growers of Los Angeles from B. M. Young, California Fruit Growers' Exchange agent in New York, relative to receipt and sale of 200 boxes of oranges sent recently by water as a test of that method of transportation.

LOS ANGELES, CAL.—Industrial users of natural gas will have to pay approximately five cents a thousand more for the fuel on and after March 20, according to an order issued by the Railroad Commission in the rate proceedings brought by the Southern Counties Gas Company. The territory affected is known as the Eastern District of the company and comprises Orange county and that part of Los Angeles in and adjacent to Pomona, Whittier and Monrovia. The rates now being charged were fixed by the Commission in 1918.

LOS ANGELES, CAL.—The Milwaukee Building Company of Los Angeles is erecting a reinforced concrete building 120 by 75 feet and two stories in height, to be occupied by the Standard Film Laboratories. The new plant will be equipped to handle over a million feet of film weekly and will have modern apparatus for the many processes which intervene between the first negative and the finished film as it is released to exhibitors. Two hundred film experts will be employed when the plant is finished, about May 1.

LOS ANGELES, CAL.—The Santa Fe Railway has contracted with C. A. Fellows, Central Building, Los Angeles, for the construction of an ice plant at Hobart Station, near the city of Vernon. There will be two buildings, the largest being 85 by 275 feet with a storage space 50 feet high. From this will run a loading platform 500 feet long. There will be a large equipment of ice machines, elevators and conveyors, and the entire project will cost in excess of half a million dollars. Work will be started immediately and will be completed before the hot weather sets in.

SAN BERNARDINO, CAL.—A 2-ton Greene Electric Furnace has recently been installed by the Hanford Iron Works at San Bernardino. Service is being supplied by the Southern Sierras Power Company from three 250-kva., 33000/100-volt Allis-Chalmers transformers with star connected secondaries. A 2000-ampere, three-phase, air core reactor is being utilized on the low tension side of the transformers, which together with the reactance of the transformers and bus gives a total reactance per phase of approximately 30 per cent at the 600-kva. furnace load. The performance of this furnace is 800 kw-hr. per ton for intermittent operation.

THE INTER-MOUNTAIN DISTRICT

POCATELLO, IDA.—A decrease of from 30 to 50 per cent in the retail price of lumber has been announced by the Bistline Lumber Co. of this city, and the Boise-Payette Lumber Co. of Twin Falls. Other building materials are still at former price levels.

SALT LAKE CITY, UTAH.—The town of Hyrum, Utah, which operates a municipal electric plant, has been authorized by the Public Utilities Commission of Utah to increase its rates from 7 to 9 cents per kilowatt-hour for lighting, and from 2 to 4 cents per kilowatt-hour for power service.

PAUL, IDA.—A $60,000 canning factory will be built at Paul this spring. Rupert business men and farmers have subscribed one-third of the required capital. The plant will have a capacity of 65,000 cases of peas. It is estimated that 300 acres in the neighborhood of Paul will be planted to peas.

PARK CITY, UTAH.—The Judge Mining & Smelting Company, of Salt Lake City, has filed an application with the state engineer for thirty second-feet of water developed by and flowing from Snake Creek tunnel in Wasatch county. The water is wanted for power purposes, the plan being to develop about 2000 horsepower for mining and other purposes in and near Park City and elsewhere in Utah.

LA JUNTA, COLO.—Reconstruction of the electric power lines to Rocky Ford, Colo., intended to bring about double capacity of power delivery to the Arkansas Valley, will begin by the Arkansas Valley Railway, Light and Power Co. April 1, and is expected to be completed by July 1. The project, together with the cost of the new 1,000-kilowatt substation at Fowler, will entail an expenditure of approximately $80,000.

FALLON, NEV.—A resolution opposing the entering into the Fallon field of another electric power plant was adopted by the Commercial Club. The Nevada Valleys Power Company is making improvements on its power site at "The Narrows" on the Truckee river with a view of entering the light and power field, and the secretary was also instructed to call attention of Nevada's senators and congressmen to take steps for the protection of the Carson-Truckee irrigation district's rights.

BOISE, IDA.—Officers of the Boise Builders' Exchange announce that, in an effort to stimulate the building of homes in southern Idaho and Utah, a new wage scale will be put into effect on March 1. This scale will be lower than the present wage scale. The new scale agreed upon is as follows: Building laborers, $4.50 per day; bricklayers, $8.80 per day; carpenters, $6 to $7 per day; common laborers, $4 per day; electrical workers, $7 per day; lathers, $7 per day, or 7 cents per yard; painters, $7 per day; plasterers, $8.40 per day; plumbers, $8 per day; steamfitters, $8 per day; tinsmiths and sheet metal workers, $7.20 per day.

SALT LAKE CITY, UTAH.—Three Utah commercial and industrial organizations — namely, the Commercial Club of Logan, the Commercial Club and Chamber of Commerce of Salt Lake City, and the Utah Associated Industries, of Salt Lake City—have recorded themselves in favor of a comprehensive program looking to improvement of the country's street railways. The result of their vote on a referendum on public utilities, conducted by the Chamber of Commerce of the United States, shows that they unanimously approved all of the eight recommendations advanced by the public utilities committee of the Chamber.

HAWTHORNE, NEV.—Opposition to the petition of the Nevada-California Power Company for permission to remove the transmission line running from Lundy station, near Aurora, to Hawthorne has developed a project for the purchase and operation of the line by Mineral county. A bill for $150,000 has been introduced in the legislature in furtherance of the plan, which contemplates extension of the power lines to towns and mines in Mineral county now without service. It is proposed to buy power from the N. C. P. Co. and re-sell to consumers at rates fixed by the Public Service Commission. Extension would be to Luning, Mina, the Simon district, and later to Candelaria.

OGDEN, UTAH.—The first shipment of explosives for the Ogden Arsenal will leave the East during the latter part of March, according to officials in charge of the arsenal. More than 1,000 cars will be shipped during the coming three months. The first shipment is expected to arrive in Salt Lake City over the Denver & Rio Grande during the early part of April. From Salt Lake City to the arsenal site, near Ogden, the materials will be transferred over the Bamberger Electric lines. An Eastern representative of the bureau of explosives has been assigned to the Ogden arsenal and will report for duty during the month of April. He has been assigned to the arsenal in order that he may aid trainmen in handling the ammunition. Another representative will lecture to trainmen of the Bamberger Electric lines from time to time on the subject of safety in moving ammunition at Salt Lake City.

Another application of electricity is heralded by a recent letter received by the National X-Ray Reflector Company, reading as follows:

"I live in the suburbs, and would like a spot or flood light which I could throw at various points within 100 feet of the house and into the tops of the surrounding trees where, at certain weeks of the year, blackbirds roost in annoying numbers."

This brilliant idea might be applied with good effect to some of the midnight cat conventions with which most suburbanites are familiar. Or would the cats regard it merely as a super-moon and redouble their musical efforts?

* * *

A well-regulated industry is something all good citizens approve, and to illustrate the healthy thoroughness with which our favorite indoor sport is carried on, we quote an item which appeared on the menu card (under the beefsteak course) at a recent banquet given by packers and others interested in the live stock industry:

"This beef came from a Minnesota herd tested for tuberculosis under direction of the Minnesota Live Stock Sanitary Board; was transported to South St. Paul by a railroad under direct supervision of the Minnesota Railroad and Warehouse Commission and the Interstate Commerce Commission; was unloaded from the car under supervision of the Western Weighing Association and Humane Society; was consigned to and sold by a commission firm bonded to the state, the Exchange & Stockyards Co., under supervision of the United States Bureau of Markets, Minnesota Department of Agriculture, Minnesota Railroad and Warehouse Commission, and South St. Paul Live Stock Sanitary Board; was yarded in pens and handled through a public stockyard where all rates, rules, regulations, and business practices are regulated by the Minnesota Railroad and Warehouse Commission, United States Bureau of Markets, United States Department of Agriculture, United States Bureau of Animal Industry, and conditions supervised by Minnesota State Live Stock Sanitary Board, South St. Paul Board of Health, and Society for Prevention of Cruelty to Animals; was weighed by an employe of the Minnesota Railroad and Warehouse Commission on a scale under direct supervision of Minnesota State Track and Hopper Scale Department; was slaughtered in a packing-house where operations are supervised by the Federal Trade Commission, United States Department of Agriculture, United States Bureau of Animal Industry, Minnesota Department of Agriculture, and city and county health authorities."

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The "Mayflower" has been discovered again, this time in an old barn in Buckinghamshire, England. We presume the owner of the barn claims that his ancestors "came back in the Mayflower"? And incidentally we are extremely exercised in our mind wondering whether that ship was brought in from the coast on a Ford, or whether, excited by its high destiny, it regarded itself as a "ship of state" and "sailed on."

* * *

Getting the attention of a celebrity is all a matter of convincing him you are interested in his business. At least this is the opinion of a resourceful salesman who, when asked how he managed to get an interview with a prominent electrical man, said:

"I put my golf score on the card I sent in to him."

* * *

The inadequacy of electrical goods has been brought out with embarrassing emphasis by one of our oldest inhabitants. This Indian, according to the story, came down from the seclusion of his mountain camp and purchased a complete set of electrical appliances in the city. He carried them home in triumph, and was extremely disgusted when he found that they would not work in his un-electrified wigwam.

There was also a Chinaman who declined to buy an electric lamp offered to him by the salesman, because he "wanted one with a light in it."

* * *

An item from France reads as follows:

"It is announced that summer time will commence in France on the night of March 14th-15th."

As we don't care to have anyone thinking that our climate is not so well brought up as that of France, we are making a little announcement on our own account:

"The rainy season in California will conclude on the night of March 21st-22nd."

Of course we don't know that it will do any good, but you never know what you can do until you try.

* * *

ELECTRICAL HYBRIDS — XI

The Electric Heating Padder

When it's cold, and you are sadder
Than an owl, and rather madder
Than a bat, because the furnace won't perform,
Try the little Heating Padder—
You will feel a trifle gladder
When he curls up in your bed and makes it warm.

Though his picture looks malicious
You will never find him vicious—
He wears that look to scare the cold away;
He is friendly and judicious,
And you'll find him quite delicious
When you've eaten ten green apples in a day.